1989–90 BULLETIN OF THE UNIVERSITY OF RHODE ISLAND

GRADUATE SCHOOL

THE
OCEAN STATE
UNIVERSITY

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GRADUATE SCHOOL

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CALENDAR

Contents

4 The University
13 Degree Requirements
15 Admission and Registration
18 Fees and Financial Aid
22 Graduate Programs
106 Personnel
115 Index
117 Campus Map
119 Application Forms

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IMPORTANT NOTE: Requests for scheduling examinations must be submitted to the Graduate School Office at least ten working days prior to the date(s) requested. Oral and written examinations, including qualifying and comprehensive examinations and defenses of theses, will be scheduled only at the convenience of the faculty members involved and depending on the availability of the candidate's program committee and additional qualified examiners. Such examinations will not be scheduled during periods when the University is in recess. Students wishing to take any examinations should first check as to the availability and convenience of the faculty members. Each faculty member must initial the request for scheduling the examination to indicate willingness to serve. The faculty should be consulted well in advance for examinations being scheduled during the winter intersession and summer session. If they are not registered for coursework or research during the summer sessions, students should register for one credit of research to defend theses and for continuous registration to take the other examinations. Please note that persons on continuous registration do not have the privileges of consulting regularly with professors on research or thesis preparation, nor of using the laboratory, computer, or other educational facilities of the University (except for the Libraries).

Fall Semester 1989

August 21–September 9
Registration period, College of Continuing Education (CCE).

September 4, Monday
Holiday, Labor Day.

September 5, Tuesday
Kingston campus registration, 8 a.m.–5 p.m. Keaney Gymnasium. Fees must be paid at the time of registration. There is a $15 late registration fee for continuing students who register between September 6–8.

September 6, Wednesday
Classes begin, Kingston campus.

September 11, Monday
Classes begin, CCE. There is a $50 late registration fee for continuing students who register on September 11 or thereafter.

September 19, Tuesday
Final date to add Kingston courses, and for P–F Option and audit requests.
Fees will not be adjusted downward for courses dropped after this date.

September 22, Friday
Final date to add CCE courses, and for P–F Option and audit requests.

October 2, Monday
Final date for January master's degree candidates and May doctoral degree candidates to submit thesis proposals. Final date for nominations for January graduation.

October 9, Monday
Holiday, Columbus Day. Classes will not meet.

October 11, Wednesday
Monday classes meet.

October 16–20
Preregistration for 1990 spring semester, Kingston campus only.

October 23, Monday
Midsemester, Kingston. Final date to drop Kingston courses and to change from P–F Option to grade.

October 28, Saturday
Midsemester, CCE. Final date to drop CCE courses and to change from P–F Option to grade.

November 6, Monday
Final date for departmental nominations for tuition scholarships for spring semester. Nominations must be accompanied by a statement of financial need.

November 22, Wednesday
Thanksgiving recess begins, 10 p.m.

November 27, Monday
Classes resume, 8 a.m.

December 8, Friday
Programs of study due for students admitted for fall 1989. Classes end, Kingston campus.

December 9–10, 16–17
Reading days, Kingston campus.

December 11–15, 18
Final examinations, Kingston campus.

December 16, Saturday
CCE classes and examinations end.

December 20, Wednesday
Final grades due in the Office of the Registrar by 4 p.m. Final date for January candidates to submit completed master's and doctoral thesis in a form acceptable for examination purposes along with the request for oral defense of thesis. NO EXTENSIONS OF TIME WILL BE GRANTED. Theses must be submitted at least ten working days prior to the date requested for oral defense. Selection

of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below and note at the beginning of this calendar regarding scheduling examinations during the winter intersession.

Spring Semester 1990

January 2–20
Registration period, CCE.

January 15, Monday
Holiday, Martin Luther King's Birthday. Classes will not meet.

January 16, Tuesday
Final date for January degree candidates to submit master's and doctoral theses which have been successfully defended, in final form. NO EXTENSIONS OF TIME WILL BE GRANTED.

January 17, Wednesday
Kingston campus registration, 8 a.m.–5 p.m., Keaney Gymnasium. Fees must be paid at the time of registration. There is a $15 late registration fee for continuing students who register between January 18–19.

January 18, Thursday
Classes begin, 8 a.m., Kingston campus.

January 19, Friday
Final date for May master's degree candidates and August doctoral degree candidates to submit thesis proposals. Final date for nominations for May graduation. Final date for submission of annual review of doctoral candidates.

January 22, Monday
Classes begin, CCE. There is a $50 late registration fee for continuing students who register on January 22 or thereafter.

January 31, Wednesday
Final date to add Kingston courses, and for P–F Option or audit requests.
Fees will not be adjusted downward for courses dropped after this date.

February 2, Friday
Final date to add CCE courses, and for P–F Option or audit requests.

February 16, Friday
Final date for nominations from departments for URI Fellowships.

February 19, Monday
Holiday, Washington's Birthday. Classes will not meet.

March 7, Wednesday
Midsemester, Kingston. Final date to drop Kingston courses and change from P–F Option to grade.

March 10, Saturday
Midsemester, CCE. Final day to drop CCE courses and change from P–F Option to grade.

March 12, Monday
Spring recess begins, 8 a.m.

March 19, Monday
Classes resume, 8 a.m.

March 26–30
Preregistration for 1990 fall semester, Kingston campus only.

March 30, Friday
Final date for August master's degree and January doctoral degree candidates to submit thesis proposals.

April 2, Monday
Final date for nominations from departments for tuition scholarships for the 1990–91 academic year. Nominations must be accompanied by a statement of financial need.

April 20, Friday
Final date for May degree candidates to submit completed master's and doctoral theses in a form acceptable for examination purposes, along with the request for oral defense of thesis. NO EXTENSIONS OF TIME WILL BE GRANTED. Thesis must be submitted at least ten working days prior to the date requested for the oral defense. Selection of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below.

May 2, Wednesday
Classes end, Kingston campus. Programs of study due for students admitted in January 1990.

May 3, 5–6
Reading days, Kingston campus.

May 4, 7–11
Final examinations, Kingston campus.

May 12, Saturday
CCE classes and examinations end.

May 14, Monday
Final date for all May degree candidates to submit master's and doctoral theses, which have been successfully defended, in final form. NO EXTENSIONS OF TIME WILL BE GRANTED. Final grades due in the Office of the Registrar by 4 p.m.

May 27, Sunday
Commencement.

Summer Session 1990

NOTE: All courses taken by graduate students during summer sessions are subject to the same regulations regarding inclusion in programs of study and calculation of overall academic average, etc., as courses taken during the regular academic year. Students wishing to take directed studies or special problems courses during summer sessions must obtain individual approval for these courses from the Summer Session Office unless the specific offering is listed in the Summer Session Bulletin for that year. Students wishing to enroll for thesis or dissertation research during summer sessions must ascertain first that their major professors and/or members of their thesis or dissertation committees will be available and are willing to provide the necessary supervision. See also the important note at the beginning of this calendar regarding scheduling of examinations, including defenses of theses, during summer session. See the Summer Session Bulletin available at the Summer Session Office.

June 8, Friday
Final date for nominations for August graduation.

July 23, Monday
Final date for all August degree candidates to submit completed master's and doctoral theses in a form acceptable for examination purposes, along with the request for oral defense of the thesis. NO EXTENSIONS OF TIME WILL BE GRANTED. Theses must be submitted at least ten working days prior to the date requested for the oral defense. Selection of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below.

August 17, Friday
Final date for all August degree candidates to submit master's and doctoral theses, which have been successfully defended, in final form. NO EXTENSIONS OF TIME WILL BE GRANTED.

THE UNIVERSITY

The University of Rhode Island is a medium-sized state university located in the southern part of Rhode Island in the village of Kingston. Founded as a land-grant college in 1892, it emphasizes preparation for earning a living and for responsible citizenship, carries on research, and takes its expertise to the community through its extension programs. As the institution expanded, a wide range of educational programs were developed. In part because of its unique location near the ocean and six miles from Narragansett Bay, the University has developed strong marine programs and has been designated one of the national Sea Grant colleges.

The University enrolls about 12,000 students on its Kingston campus, and another 3,000 in credit courses throughout the state. There are about 12,000 undergraduate students, about 3,200 graduate students, and a full-time teaching faculty of about 750. Approximately 950 graduate students are in full-time residence.

The University has nine colleges and three schools: the Colleges of Arts and Sciences, Business Administration, Continuing Education, Engineering, Human Science and Services, Nursing, Pharmacy, Resource Development, University College, the Graduate School, the Graduate School of Library and Information Studies, and the Graduate School of Oceanography.

The Campus. The University has a spacious rural campus 30 miles south of Providence in the northeastern metropolitan corridor between New York and Boston. The center of the campus is a quadrangle of handsome old granite buildings surrounded by newer academic buildings, student residence halls, and fraternity and sorority houses. On the plain below Kingston Hill are gymnasiums, athletic fields, tennis courts, and agricultural fields.

In addition to the Kingston campus, the University has three other campuses. Six miles to the east, the 165-acre Narragansett Bay Campus, overlooking the west passage of the Bay, is the site of the Graduate School of Oceanography with academic and research buildings, and docks for research vessels. The Rhode Island Nuclear Reactor and several federal laboratories devoted to marine sciences are also located there. The College of Continuing Education, with main offices at 199 Promenade Street in Providence, offers courses

throughout the state. The W. Alton Jones Campus is in the western section of the state, 20 miles from Kingston. Its 2,300 acres of woods, fields, streams, and ponds is the site of environmental education, research, and conference facilities.

Graduate Study

Graduate study at the University was inaugurated in 1907 with the Master of Science degrees in chemistry and in engineering. The Master of Arts degree was first awarded in 1951, and in 1960 the University awarded its first Doctor of Philosophy degree. Graduate work for professional degrees was initiated in 1962 when the degree of Master of Public Administration was first awarded. Today, the master's degree is offered in over 60 areas of study and the doctorate in 31 areas.

The dean of the Graduate School has primary responsibility for administering policies and procedures relating to advanced study at The University of Rhode Island. Graduate School policy is made by graduate faculty members, acting through their delegate body, the Graduate Council, which includes student members. Only the dean or the Graduate Council may grant exceptions to the regulations for graduate study, which are explained in detail in the *Graduate Student Manual.*

The University graduate programs of study are listed below. Work in a combination of special areas is usually possible. Graduate-level coursework applicable to a number of these programs is offered in several locations throughout the state by the College of Continuing Education. In most cases, however, a portion of the coursework will have to be taken on the Kingston Campus.

In addition, two graduate certificate programs are available to supplement specific master's degrees. The graduate certificates, which are not degrees, are awarded by the dean of the Graduate School to attest to a specific, supplemental competence in commercial fisheries (see marine affairs, page 65) or in international development studies (see international studies, page 58).

Research

Within Rhode Island's system of higher education, the University has the major responsibility for graduate study which is closely associated with a strong program of research. Specialized marine research, education, and public service projects are carried on in many departments. Active research throughout the University is supported by a total of approximately $23 million per year. Support comes from foundations, commercial firms, federal and state government, and the University. The University ranks among the top five percent of the country's colleges and universities in the amount of research funding received.

The Director of Research signs, on behalf of the University, applications for research grants, maintains files of funding agencies, keeps a current facilities inventory, and is a liaison for the president, the business manager, the academic deans, the Research Committee, and the faculty in matters pertaining to general research policy.

Research Resources

The University Libraries. The library collection of about 873,558 bound volumes and 1,071,848 volume-equivalent microforms is housed in the University Library in Kingston, at the College of Continuing Education in Providence, and at the Claiborne Pell Marine Science Library on the Narragansett Bay Campus. The latter was designated the National Sea Grant Depository in 1971.

The University Library, which holds the bulk of the collection, has open stacks with direct access to books, periodicals, documents, maps, microforms, and audiovisual materials. The Special Collections Department collects and

Graduate Degree Programs

Master of Arts

Audiology
Comparative Literature
Economics
Education
- Education Research
- Elementary Education
- Reading Education
- Science Education
- Secondary Education
- Adult Education

English
French
History
Marine Affairs
Philosophy
Political Science
- International Relations

Spanish
Speech–Language Pathology

Master of Science

Accounting
Audiology
Biochemistry and Biophysics
Botany
Chemical Engineering
Chemistry
Civil and Environmental Engineering
Clinical Laboratory Science
Computer Science
Electrical Engineering
Fisheries, Aquaculture, and Pathology
Food Science and Nutrition
Geology
Home Economics Education
Human Development, Counseling, and Family Studies
- Human Development and Family Studies
- Marriage and Family Therapy
- College Student Personnel
- Counseling

Labor and Industrial Relations
Manufacturing Engineering
Mathematics
Mechanical Engineering and Applied Mechanics
Medicinal Chemistry
Microbiology
Natural Resources
Nursing
Ocean Engineering
Oceanography
Pharmaceutics
Pharmacognosy
Pharmacology and Toxicology
Pharmacy Administration
Physical Education
Physical Therapy
Physics
Plant Pathology–Entomology
Plant Science
Psychology (school)
Resource Economics
Speech–Language Pathology
Statistics
Textiles, Clothing, and Related Art
Zoology

Doctor of Philosophy

Applied Mathematical Sciences
- Applied Mathematics
- Computer Science
- Operations Research
- Statistics
- Applied Probability

Biological Sciences
- Biochemistry and Biophysics
- Botany
- Fisheries, Aquaculture, and Pathology
- Food Science and Nutrition
- Microbiology
- Natural Resources
- Plant Pathology
- Plant Science
- Zoology

Chemical Engineering
Chemistry
Civil and Environmental Engineering
Economics–Marine Resources
Electrical Engineering
- Biomedical Engineering

English
Mathematics
Mechanical Engineering and Applied Mechanics
Nursing
Ocean Engineering
Oceanography
Pharmaceutical Sciences
- Medicinal Chemistry
- Pharmaceutics
- Pharmacognosy
- Pharmacology and Toxicology

Physics
Psychology

Professional Degrees

Master of Business Administration (M.B.A.)
Master of Community Planning (M.C.P.)
Master of Library and Information Studies (M.L.I.S.)
Master of Marine Affairs (M.M.A.)
Master of Music (M.M.)
Master of Public Administration (M.P.A.)
Doctor of Pharmacy (Pharm.D.)

maintains rare books, manuscripts, the University archives, and a variety of special interest materials. Service hours at the other libraries vary, but the University Library provides full reference, bibliographic, and circulation services during most of the 90 hours per week it is open. Terminals linked to the Academic Computer Center are available in the library during the hours both facilities are operating. A computer-based bibliographic system makes most books available to users one week after their receipt. Arrangements can be made to borrow out-of-print material from other libraries through the Interlibrary Loan Office in the University Library.

The Academic Computer Center. The Academic Computer Center (ACC) provides computational resources needed by the University community for instruction and research. Located in Tyler Hall on the Kingston campus, the ACC maintains central computing facilities, supports microcomputing activities, provides facilities management and data communication assistance to departmental systems, and offers a wide variety of support services in these areas. The computer network and related services have been expanding steadily since the Center opened in 1959, and now a majority of the students, faculty members, and staff use the facilities.

The Center has an IBM 4831-3 mainframe computer, two Prime 9955 minicomputers, and a Prime 9755 minicomputer used for CAD/CAM applications. Several hundred ASCII terminals are located in public terminal clusters and private offices. These terminals are connected to a MICOM data switch which provides access to the ACC systems and to remote independent computers. Also available are extensive dial-up facilities and access to BITNET, the international network for educational centers. The mainframe uses both the IBM OS/MVS/TSO and VM/CMS operating systems to provide large-scale computing. The minicomputers use the PRIMOS operating system to provide medium-scale computing. A full complement of programming languages and packages is available on all systems. Remote job entry services to the mainframe are available from Prime, TSO, and departmental system users. Self-service printers are located at major terminal clusters. Extensive computer graphics and text processing facilities are also offered.

The ACC provides facilities management services for campus microcomputer laboratories featuring both IBM PC compatible and Apple Macintosh personal computers. Numerous application software packages are available. The microcomputer laboratories are used for faculty research and teaching and for student coursework. In addition, two computer classrooms with 20 terminals each are available.

A resource room in Tyler Hall is equipped with several Macintosh and IBM PC microcomputer systems. This facility serves as a center for getting hands-on experience with microcomputer hardware, software, and peripheral devices. Additionally, microcomputer vendors contribute and loan hardware and software on a temporary basis for demonstration and user evaluation.

Other Research Facilities. The Computer Science Laboratory in the Department of Computer Science is used solely to support research activities and upper-level instruction in the department. It contains two VAX minicomputers and a classroom containing a network of one dozen Apollo graphics workstations. Terminals to the minicomputers are available in faculty and graduate student offices, and another 18 Apollos are dedicated to research use. The Narragansett Bay Campus has a Prime 750 and a Microvax II for timesharing use, and a remote job entry station for the Academic Computer Center. The College of Engineering has a Digital VAX 11/780 minicomputer with terminals in all engineering buildings linked to the Academic Computer Center's system. The Department of Electrical Engineering has two Data General Eclipse computers and several microcomputer systems. A Nova 4/S computer with a 16-channel A–D converter, Versatec printer-plotter, a videographic terminal, and a hard disk system are located in the Department of Ocean Engineering. It has a microprocessor interface and a magnetic tape input/output system. A Tectronix 4051 minicomputer with a digitizer and a bed plotter, and a T.I. FS990/4 microcomputer with a 64-channel A–D converter are also available. The Department of Chemistry has a VAX 730 computer, FTIR (Fourier Transform Infrared Spectrometer 60SX), DEC PDP 11-34A computer, and a Data General Eclipse 130 computer.

Four other computer facilities are available in the College of Business Administration. The Dennis W. Callaghan Microcomputer Lab, housed in the College of Business Administration, has 40 networked IBM PCs, and the Decision Support Lab consists of 20 Prime terminals linked to the University's Prime super-minicomputers. The College's General Computer Facility contains a Prime Printronix high-speed printer and 20 terminals for accessing the IBM mainframe and the Prime super-minicomputers. This extensive computer capability is duplicated at the College of Continuing Education in Providence on a somewhat smaller scale so that both day and evening students can avail themselves of the latest in computer technology.

The Computer-Integrated Manufacturing (CIM) Lab, located in Lippitt Hall, consists of 16 Tectronix 4701 graphics terminals and tablets for computer-aided design (CAD), computer-aided manufacturing (CAM), and manufacturing resource planning (MRP II). It is supported by a Prime 9755 central processing unit. The MRP II software, provided by Northeast Data Systems, allows business and engineering students to learn to manage the manufacturing enterprise.

Other equipment includes major laboratories for digital pattern recognition and digital image processing, computer automation ("robotics"), optical properties of materials and microelectronics, and materials research, a mechanical properties testing facility, including an Instron 1125 and a MTS Series 810 testing machine and a NETZSCH 40916 thermal analyzer, a field station for radiopropagation research, reverberant and anechoic rooms for airborne acoustics work, a low-speed wind tunnel for fluid mechanics studies, a zoom transfer scope, a digital planimeter and radial plotter for applied remote sensing, and instrumentation including atomic absorption, emission, infrared, mass, nuclear magnetic resonance (H-1, C-13), Raman X-ray diffraction/fluorescence and ultraviolet spectrometers, gas and liquid chromatographs, gas chromatograph-mass spectrograph, electron microscopes, scanning electron microscopes, metallographs, nuclear-counting equipment, and multichannel analyzers.

Equipment available for marine research includes chambers for leak-testing equipment prior to deep-sea use, marine geotechnical laboratory facilities for sediment testing, X-ray radiographs, a gamma-ray core scanner, a

wave and towing tank, underwater acoustics test facilities, a marine experimental aquarium, a marine ecosystem laboratory, and an oceanographic remote sensing laboratory which processes sea surface data. The University also operates a SEABEAM facility for mapping the sea floor.

The University's research vessel, *Endeavor*, operated by the Graduate School of Oceanography, is a 177-foot ship capable of working in all parts of the world's oceans. It can carry a scientific party of 16. A 59-foot, high-speed ocean research vessel, the *Laurie Lee*, and a 65-foot ocean engineering vessel, the R.V. *Edson Schock*, are also part of the fleet. The University fisheries school operates a 52-foot long training vessel, the *Captain Bert*. A number of smaller vessels are also available. The Graduate School of Oceanography also has a fully equipped research diving facility.

University students have a research reactor and associated facilities available to them at the Rhode Island Nuclear Science Center, located on the Narragansett Bay Campus. Constructed and operated by the state of Rhode Island, this critical reactor is extensively used for research by many departments of the University. The reactor, designed for 5MW, is now operating at 2MW. Hot laboratories, counting equipment, neutron spectrometers (including a unique polarized-beam, small-angle instrument), and multichannel analyzers are also available.

The College of Nursing has practice laboratories equipped with a heart-sound simulator used by students in primary health care. The media center at White Hall contains various types of learning modules and microcomputers for research and instruction.

Housed in the Morrill Science Building, the URI Central Electron Microscope Facility has a JEOL 1200 EX scanning-transmission electron microscope (STEM). This is a high-resolution microscope with transmission, scanning, scanning transmission, and diffraction capabilities. Ultramicrotomes, carbon evaporators, darkroom facilities, and other equipment for specimen preparation are also available. The facility is available for use by graduate students and other University personnel, and for research projects and instruction. The facility is staffed by a director and a technical specialist who maintains the facility and assists and trains users. Advice in project design is also provided, and assistance with biological preparation is available by special arrangement. The facility welcomes projects of all sorts, in both the biological and physical sciences.

The Physical Therapy Program in the Keaney-Tootell complex has established a clinical research unit which includes a computerized BIODEX muscle performance testing dynamometry system, a METRECOM postural analysis system, and an ARIEL biomechanical analysis system for human motor performance assessment. Functional electrical stimulation for the spinal-cord injured and other neurologically impaired patients is made possible through a cooperative arrangement with the nonprofit organization, Shake-A-Leg, Inc. Clinical evaluation, treatment, and collaborative studies are possible in exercise science through cooperation with researchers in the Department of Physical Education, Health, and Recreation.

The Speech and Hearing Center has one-way vision and listening facilities and diagnostic equipment for speech and language testing. Sound-treated testing rooms meeting ANSI standards and audiometric equipment provide for audiologic evaluation and research.

Research Units

In addition to the research in various departments, the following special research agencies have been established.

Agricultural Experiment Station. The station within the College of Resource Development is the designated Rhode Island/USDA partnership organization for research in the agricultural sciences. Basic and applied investigations in natural and human resources are carried on by 54 senior scientists assigned to college departments. The research aims at conservation and management of resources, improvement of the quality of environment, enhancement of home life, and support of resource-using business and industry. A strong orientation to estuarine and marine problems and an interdisciplinary approach to resource research are station characteristics. The progress of research and complete results of individual projects are issued in station bulletins. All are available to Rhode Island residents upon request.

The Biotechnology Center. This center was established to coordinate and foster interdisciplinary research in the agricultural, medical, marine, and food sciences and their supporting basic science disciplines. It provides a structure to encourage interaction between the academic, governmental, and industrial sectors of the state economy. The center identifies new research opportunities in biotechnology and organizes seminars and workshops on topics in biotechnology. Participation in the center's activities is open to all members of the University community whose research touches upon biotechnology. While not an academic unit of the University, the center identifies study areas for biotechnology topics in the various departments of the University at the graduate and undergraduate level. It is administered in the College of Resource Development by a steering committee with a chairman selected from the college.

Center for Atmospheric Chemistry Studies (CACS). The center is a focal point for the development of a broad-scale research effort in atmospheric sciences at the University, provides a resource in atmospheric chemistry and air pollution research for the state of Rhode Island, and provides direction and leadership for several multi-institutional, multinational research programs examining global-scale problems in atmospheric chemistry.

Center for Ocean Management Studies (COMS). The center was established in 1976 to help develop new resource management concepts for the coastal and marine environment through an interdisciplinary approach. The center identifies ocean management issues, holds workshops and conferences to discuss them, and develops recommendations and research programs to resolve them. A steering committee is chaired by the Vice Provost for Marine Programs.

Child Development Center. The center does qualitative and quantitative research with preschool children in a specially-designed campus-based day care facility. Graduate students and faculty are involved with the children and their parents during the calendar year. All aspects of development are available for investigation, with a particular opportunity to observe socialization skills and processes.

Core Facility. A center of expertise in the design and fielding of new deep-ocean sampling technology, it provides a wide range of services to an interna-

tional user community in the area of equipment development as well as supporting the traditional geological sampling requirements of the marine community. It maintains a collection of historical geological samples, accessible to qualified investigators.

The Institute of Human Science and Services. The institute sponsors research and support activities in the human sciences and services, particularly in the areas of evaluation, measurement, survey research, curriculum development, training, and human services policy and management. Institute activities focus on areas including education, human development, the family, gerontology, exercise science, consumer affairs, counseling, and public policy. The institute is an integral part of the College of Human Science and Services and draws its professional staff from all departments of the college. The institute maintains a close liaison with human service agencies such as the Rhode Island Department of Education, Rhode Island Social and Rehabilitative Services, and the Rhode Island Institute of Mental Health, Rehabilitation, and Hospitals.

Marriage and Family Therapy Clinic. This is an integral part of the graduate training program in marriage and family therapy in the Department of Human Development, Counseling, and Family Studies. Established in 1982, it is located at the Transition Center on Lower College Road. The Marriage and Family Therapy Clinic provides counseling services to families and clinical supervision to graduate students, and it creates research opportunities for both graduate students and faculty members in family interaction and family systems. Various data-gathering devices are used to give feedback to families served and to graduate student therapists, and to produce a database for ongoing research. The clinic promotes the use of its facilities by local families and accepts referrals from the Rhode Island Family Court, school systems, clergy, and health personnel.

The Chester H. Kirk Applied Engineering Laboratory. The filtration research laboratory at The University of Rhode Island is one of a few laboratories nationwide studying filtration processes from a fundamental point of view. At the heart of this center is a generous donation of equipment made by the Fram Corporation, a division of the Allied Corporation. This includes a two-channel, computer-controlled laser anemometer system, a PDP 1134 computer and two Apollo computers, a low-turbulence level wind tunnel, a water channel, extensive instrumentation for the generation and analysis of aerosols, and a variety of other instrumentation and equipment. The laboratory is housed in the college's applied engineering building, has associated faculty from the Departments of Mechanical and Chemical Engineering, and can call on other expertise within the College of Engineering and the University, as needed. The laboratory excels in its focus on developing a basic scientific understanding of filtration and separation processes, and in its intention to maintain close ties with the industrial applications for its work. Planned research projects include detailed studies of the physics of particle capture by fibers, investigations of two- and three-dimensional flows about cylinder arrays, and the development of a rational theory of flow and particle extraction in porous media.

Design for Manufacture Research Center. The center is based in the Department of Industrial and Manufacturing Engineering. It involves four faculty members and graduate research assistants, at both the master's and doctoral levels. Center research is concerned with the relationships between product design decisions and manufacturing efficiency. Topics considered include product structure analysis, comparison of material and process selections, and product design for manufacturing automation. The center's goal is to produce database analysis tools which can be used by product development teams. Funding is provided by the National Science Foundation and various industries in the United States.

Environmental Data Center (EDC). The Environmental Data Center is a cooperative effort between the Rhode Island Department of Environmental Management and the URI Department of Natural Resources Science. The purpose of the project is to develop a statewide database of essential natural resource information using Geographic Information System (GIS) computer technology. The EDC is the primary focus of data entry, analysis, and map-output production for the state GIS program. Online data sets can be made available for teaching and research purposes through the URI Academic Computer Center. Integration of diverse data layers such as soils, landcover, hydrology, geology, zoning, and political boundaries plays a significant role in managing Rhode Island's rapidly changing landscape.

Food Science and Nutrition Research Center (FSNC). The FSNC has been designed to house all the graduate education and research programs in food science and nutritional science. The center is administered by the College of Resource Development and located in West Kingston. In addition to its own microcomputer facilities, the center has 16 fully equipped research laboratories including those dedicated to carotenoid chemistry, vitamin A, nutrient interaction, food bioprocessing, physical properties of food, industrial microbiology, food chemistry, and food safety. There is a research winery with its own walk-in cold room and incubators. The Animal Laboratory conforms to all federal codes for animal research with separate rooms available for toxicological, radioactive, and growth studies. The FSNC also has both food processing and seafood processing pilot plants. The center has the facilities and equipment to provide instruction, research, and service in the fields of food science and nutritional science.

Historic Costume and Textiles Collection. An historic costume and textile collection of over 13,000 items is housed in the Department of Textiles, Clothing, and Related Art. The collection, of national significance, features 18th and 19th century costumes, the Weaver Rose Collection, early American quilts, shawls, and many international costumes. A full-time curator and faculty are available to assist scholars and museum professionals with problems of classification, identification, restoration, and storage of textile items.

Human Performance Laboratory. The Human Performance Laboratory in the Department of Physical Education, Health, and Recreation offers measurement and exercise counseling services to local, state, and regional agencies, industrial corporations, established exercise programs, athletic teams, and individuals with medical referrals. It is concerned with the total person and with the individual's response to the demands of physical evaluation and participation. The laboratory has facilities

for exercise stress evaluation, medical examinations, chemical analyses of expired and blood gases, lectures, and demonstrations.

Intergovernmental Policy Analysis Program (IPAP). Created by The University of Rhode Island in February 1978 as a means to improve the responsiveness of the University to the needs of state government, IPAP is currently organized as an office under the Provost. As a research unit at the University, IPAP works to provide an innovative program that can meet many of state government's critical and short-term needs as well as long-term requirements. Since its inception, IPAP has received grants from state government agencies to assist in research design, resource development, and policy analysis, and has coordinated the state's Executive and Legislative State Science, Engineering, and Technology Programs with funding from the National Science Foundation. In addition, other grant projects have been funded by regional and federal governments, and by private research organizations.

International Center for Marine Resource Development (ICMRD). Founded in 1969, ICMRD serves developing countries in the field of international marine sciences. Responding to the needs of these developing countries, the center has implemented research and training programs utilizing an integrated approach to technical assistance considering the social, cultural, economic, and technical aspects of fishery development and coastal resource management. ICMRD serves as the catalyst for University-wide international development programs as well as a center for the transfer of appropriate technology. The center draws on the expertise of faculty and staff to develop comprehensive solutions to the needs of developing countries and to requests made by its principal funding source, the Agency for International Development (AID).

Labor Research Center. The Labor Research Center is a tripartite, independent, multidisciplinary unit devoted to the study and teaching of subjects broadly defined as labor and industrial relations. The center is concerned with research and service as well as the administration of the graduate program leading to the M.S. degree in labor and industrial relations. More than 50 full-time University faculty members from 4 colleges and 13 departments are associated with the center in either a teaching or research capacity. Labor, human resource management, and neutral external advisory committees work with the center's director and faculty in helping to define research and program needs and interests.

Laboratories for Scientific Criminal Investigation. These laboratories in the Department of Pharmacology and Toxicology provide instruction, research, and service in the field of scientific criminal investigation. The laboratory staff works closely with the Rhode Island Attorney General's Office and also provides technical consultation for various law enforcement agencies, and special instruction and research in criminalistics, in which faculty members of various departments participate. The program sponsors a special course for police and law enforcement agencies.

Laboratory for the Study of Information Science (LSIS). The University has identified the field of information science as one with growth potential. In response, it has provided for a group of information scientists to work independently within the University community. This initiative has led to the establishment of the LSIS in Pastore Hall. In the past decade, LSIS has acquired a national reputation in the field of information management. LSIS integrates various sophisticated technologies to meet the requirements of contracting organizations with diverse information needs. LSIS is one of the leading centers for the dissemination of information regarding the arctic environment. LSIS has designed, created, and maintained databases of biological and physical data collected in the arctic, as well as program management information. LSIS has also developed retrieval programs and graphical and tabular analyses to make this vast source of information useful in aiding management decisions concerning the development of resources in that region.

Laboratories for Textile Performance Testing. These laboratories in the Department of Textiles, Fashion Merchandising, and Design are concerned with textile performance evaluation, fiber identification, and quality control. The laboratory staff works closely with state and University purchasing agents, and with the Rhode Island Attorney General's Office, and also provides technical assistance to industry. Equipment is available for performing a wide range of tests recommended by the American Society for Testing Materials, American Society for Quality Control, American Association of Textile Chemists and Colorists, as well as mandatory tests required by federal agencies.

LANDSAT Remote Sensing Lab. The lab at The University of Rhode Island is a cooperative effort between the Graduate School of Oceanography and the Department of Geography and Marine Affairs and was established to utilize satellite remote sensing for terrestrial, coastal, and near-shore applications. Considerable emphasis is placed on the application of remote sensing techniques to the solution of problems faced in both the public and private sectors. Academic training and research concerning the classification of LANDSAT remote sensing data are important functions of the lab where individuals with differing research interests are provided opportunities to work together utilizing state-of-the-art technology. The lab is staffed by professionals with in-depth backgrounds in satellite remote sensing.

Office of Marine Programs. The purpose of this office is to develop and package marine information which can be used by the marine community of the state, region, and nation, and equally to conduct fund raising, education, and communications activities at the Graduate School of Oceanography. Member units are the Marine Advisory Service, the Coastal Resources Center, and the National Sea Grant Depository.

Rhode Island Sea Grant Marine Advisory Service. The service is a federal and state partnership in marine outreach. Marine specialists provide education and information and technology transfer programs for persons in Rhode Island and New England who use the resources of the marine environment. Projects include working with commercial fishermen, seafood processors, marina and boat yard operators, local and state governments, and individuals and businesses interested in the management, use, development, or understanding of marine resources. Programs promote better use of marine resources by encouraging cooperation among marine-oriented agencies and groups.

Coastal Resources Center (CRC). Established in 1971, the center carries out

research projects, surveys, and studies aimed at solving marine and coastal management problems. It is directing a five-year program to develop coastal resource management programs in Ecuador, Sri Lanka, and Thailand, and is part of a multidisciplinary team at URI studying the environmental characteristics, human uses, and governance of four estuaries in the United States. The center also provides policy and technical guidance to state and local agencies on coastal resources management.

National Sea Grant Depository. Housed in the Claiborne Pell Marine Science Library, the depository was established in 1971 to ensure that materials published under Sea Grant auspices would be available at a single location. Its subject matter touches such widely diverse areas as aquaculture, law, medicine, geology, chemistry, biology, engineering, mathematical modeling, food technology, information retrieval, recreation, coastal zone management, and market research. The National Sea Grant Depository publishes a quarterly abstracts publication, makes available loan copies of Sea Grant documents, and conducts online literature searches.

Research Center in Business and Economics. The center provides research support for the College of Business Administration faculty and conducts research projects for external organizations. Survey research, company image measurement, concept testing, consumer satisfaction studies, market share analysis, and economic impact estimation are among the variety of services that have been offered to external organizations. The center also publishes *The Northeast Journal of Business & Economics* which focuses on business and economic issues of concern to scholars and practitioners in the Northeast.

Rhode Island Sea Grant College Program. Established in 1968 in the Graduate School of Oceanography, it acts as a focal point in a partnership between government, industry, and the University to increase scientific understanding of the oceans and coastal waters, improve management of marine resources, and promote development of marine products. The program consists of research, education, and advisory services.

Rhode Island Water Resources Center. This is the state center for research and training in all phases of water resources. Similar centers in each of the 50 states and Guam, Puerto Rico, the Virgin Islands, and the District of Columbia were established by law in 1964 and work cooperatively with the federal government in an effort "to assist in assuring the nation at all times of a supply of water sufficient in quantity and quality to meet the requirements of its expanding population." Principal investigators of projects need not be employed at the University.

Robotics Research Center. The center involves undergraduates, master's and doctoral degree candidates, staff, visiting engineers, and faculty in the Departments of Electrical, Mechanical, and Industrial and Manufacturing Engineering. Their research deals with the application of advanced sensor-based systems, including robots, to flexible manufacturing workstations that deal with parts and components of a scale that can be normally handled by humans. Research in robotics began at the University in 1971 and was expanded in 1975 when the National Science Foundation (NSF) provided a significant level of long-term funding. In 1980, the Industrial Participation Program was initiated; it consists of companies involved both in the production of robots and in their employment in the production process. The NSF provided further funding in April 1982 by establishing the only NSF University/Industry Cooperative Research Center in Robotics. The center is housed in the applied engineering laboratory building.

Urban Field Center. Located in the city of Providence, the Urban Field Center is a part of the graduate curriculum in community planning and area development in the College of Resource Development. A major goal of the center is the development of applied research and technical assistance skills for city educational systems, community groups, and the state agencies of Rhode Island. The center has developed an agenda for community service in collaboration with an advisory committee, the state agencies, and community groups.

Accreditation

The University of Rhode Island is accredited by the New England Association of Schools and Colleges, Inc. In addition, certain courses and programs of study have been approved by national accrediting agencies.

The New England Association of Schools and Colleges, Inc., is a nongovernmental, nationally recognized organization whose affiliated institutions include elementary schools through collegiate institutions offering postgraduate instruction.

Accreditation of an institution by the New England Association indicates that it meets or exceeds criteria for the assessment of institutional quality periodically applied through a peer group review process. An accredited school or college is one which has available the necessary resources to achieve its stated purposes through appropriate educational programs, is substantially doing so, and gives reasonable evidence that it will continue to do so in the foreseeable future. Institutional integrity is also addressed through accreditation.

Accreditation by the New England Association is not partial but applies to the University as a whole. As such, it is not a guarantee of the quality of every course or program offered, or of the competence of individual graduates. Rather, it provides reasonable assurance about the quality of opportunities available to students who attend the University.

Inquiries regarding the status of an institution's accreditation by the New England Association should be directed to the administrative staff of the school or college. Individuals may also contact the Association at The Sanborn House, 15 High Street, Winchester, MA 01890. Telephone: (617) 729–6762.

The national accrediting agencies which have approved the quality of certain course offerings and programs of study include the American Association of Universities, the American Assembly of Collegiate Schools of Business, the American Chemical Society, the American Council on Pharmaceutical Education, the American Dental Association (Council on Dental Education), the American Library Association, the American Society of Journalism School Administrators, the American Speech–Language–Hearing Association, the Accreditation Board for Engineering and Technology, the National Association of Schools of Music, the National League of Nursing, and the State University of New York. The Doctor of Philosophy programs in clinical and school psychology are accredited by the American Psychological Association. In addition, the University has been authorized under federal law to enroll nonimmigrant alien students.

The University is also an approved member institution of the American Association of University Women, the Council of Graduate Schools in the United States, the North American Association of Summer Sessions, and the National University Extension Association.

Graduate Life

The main campus of The University of Rhode Island is located in the quiet, historic village of Kingston. Cultural variety and compact size are combined in the state of Rhode Island, and other cultural centers are easily accessible. Boston is 80 miles to the north and New York City 160 miles southwest. Bus service to these cities, as well as to Providence, Newport, and Cape Cod, is available from the campus. There is also a local bus service. The Kingston station of Amtrak is two miles away.

Services. The recreational and cultural facilities of the campus are open to graduate students and include use of the Memorial Union building. Facilities there include meeting and conference rooms, lounges, browsing room, study rooms, darkroom, radio station, campus newspapers, games room, offices for student organizations, student technical services, cafeteria, snack bar, restaurant, pub, private dining rooms, ballroom, and party room. Services include a credit union, travel agency, unisex hair salon, flower shop, pizza shop, ice cream shop, and a center where copying facilities and typewriters are available. Student cooperatives under the direction of the Student Senate include a record shop, photography lab, housing directory, book exchange, and a student hostel. There are substantial facilities for commuting students.

Every effort is made to provide graduate students with opportunities for consultation and advice on matters of concern to them in their academic, extracurricular, and personal lives. Descriptions of available services and facilities, including those associated with religious life, may be found in the *Undergraduate Bulletin.* Of particular interest to graduate students are the following: Counseling and Career Services, Roosevelt Hall; Health Services, Potter Building; International Student Services, International House; Religious Counselors, Taft Hall, Catholic Center, and Hillel House; Student Financial Aid Office, Roosevelt Hall.

Health Services. University health services include special clinics in gynecology, family planning, internal medicine, surgery, orthopedics, dermatology, psychiatry, wart removal, allergy, and nutrition, as well as generalist and nursing care, laboratory, X-ray, and pharmacy. Allergy injections are given, provided the vaccines are supplied.

Outpatient services during the academic year are available seven days a week, 24 hours a day. Physicians are available Monday through Friday from 8 a.m. to 8 p.m., and for a weekend clinic. Physicians are on call at other times. Nurses are on duty at all times during the academic year. Specialists are available at specified times by appointment only.

Hospital care is available in the local community. All medical expenses incurred outside the University's Health Services are the responsibility of the student. Therefore, you are encouraged to have adequate insurance coverage (see the Health Services brochure, *To Your Health*). Students who choose their own private physician must assume responsibility for expenses incurred.

The Health Promotion Department of Health Services in Roosevelt Hall is concerned with teaching students to take care of themselves, to adopt healthy lifestyles, and to become informed consumers of health care services.

Affirmative Action and Nondiscrimination. The University of Rhode Island prohibits discrimination on the basis of race, sex, religion, age, color, national origin, handicap, or sexual orientation, and discrimination against disabled and Vietnam era veterans, in the recruitment, admission, or treatment of students; the recruitment, hiring, or treatment of faculty and staff, and the operation of its activities and programs. This is in compliance with state and federal laws, including Titles VI and VII of the Civil Rights Act of 1964 as amended, Title IX of the 1972 Education Amendments to the Higher Education Act, Executive Order 11246, as amended, Sections 503/504 of the Rehabilitation Act of 1973, and Section 402 of the Vietnam Era Readjustment Assistance Act of 1974.

The dean of the Graduate School, the director of Career Services, the director of counseling, and the director of the (undergraduate) Special Program for Talent Development cooperate to provide information and guidance for economically and socially disadvantaged individuals seeking opportunities for graduate study at the University. Inquiries may be directed to any of these offices.

Most buildings on campus are architecturally available to the disabled, and provision is made to insure that no student is prevented from pursuing a course of study because of restricted access to buildings. Special counseling for physically, psychologically, or vocationally handicapped individuals is available from the Counseling Center.

Inquiries concerning compliance with antidiscrimination laws should be addressed to the Special Assistant to the President for Affirmative Action, 80 Lower College Road, telephone: 792–2442; or to the director, Office for Civil Rights, Department of Education, Region I. Questions regarding provisions for the disabled should be directed to Handicapped Services in the Office of Student Life, 332 Memorial Union. Telephone: 792–2101.

Graduate Student Association (GSA). This organization is interested in both the academic and social aspects of graduate life. Officers and representatives of the association are elected annually from the entire graduate student body, and the association is represented on the Graduate Council. The GSA offices are located in the Memorial Union.

There are also organizations for spouses of graduate students and for students from foreign countries.

Housing. The Graduate Village and several other buildings provide 140 units of unfurnished apartments for graduate students. There is a waiting list for these units; interested students should write to the University Housing Office for applications and for additional information. The majority of off-campus housing, located in nearby resort areas, is available only on a seasonal basis, from September to June. Since most of these rentals are five miles or more from campus, people without cars should also investigate the availability of public transportation. A local bus service connects the shopping and service areas in Wakefield with the University. Some of the outlying resort areas, including Narragansett Pier, Galilee and Scarborough, are also included in the bus routes.

Housing information may be obtained from the University Housing Office and from advertisements in the *Narragansett Times,* a weekly local newspaper. In addition to providing

information and applications for University housing, the Housing Office has available maps, bus schedules, rental booklets, and a graduate roommate file. A list of off-campus rooms, apartments, and houses available to graduate students is maintained in the commuter lounge at the Memorial Union.

Housing arrangements should be made as early as possible. The Housing Office is located in the Roger Williams Complex. Telephone: 792–2215.

Dining Services. Dining services are available for graduate students at any of the University dining halls. Students who reside in University dorms are required to choose from one of the following options: any 10 meals Monday through Friday; any 15 meals Monday through Sunday; any 20 meals Monday through Sunday. Off-campus commuters and members of the campus community other than dorm residents may choose to purchase any 5 meals Monday through Sunday. Further information can be obtained by contacting the Dining Services central office, Lippitt Hall.

Reserve Officer Training Corps (ROTC). The Department of Military Science offers the ROTC program which enables graduate students to simultaneously earn a commission in the United States Army and an advanced degree. The individual must be a full-time student with at least two years of study remaining and meet qualifications which include age and citizenship.

The student must take one 300-level military science course in each of the last four semesters and attend a weekly laboratory period which allows students to put into practice the theory presented in class. Each student receives a monthly stipend of $100. A six-week summer training period (basic camp) is required for all graduate students except veterans and members of the National Guard and Reserve. All students must attend the six-week advanced camp summer training period prior to commissioning. The ROTC graduate has the option either to apply for an active tour of duty or to be guaranteed National Guard or Reserve Forces duty.

Academic and Social Codes. Each student is a member of the University community with all the rights, privileges, and responsibilities that go with such membership. The rights and privileges include full use of the educational opportunities and facilities offered on the campus. The responsibilities include those of making proper use of these facilities in order to progress educationally, respecting the rights of others, and knowing and obeying the rules and regulations developed by the University community for the good of the total membership.

The University expects that all course papers, theses, and dissertations will be prepared, and all examinations taken, in conformance with accepted standards of academic integrity. This includes the proper citation and attribution of all material which is not the original product of the writer. It is the graduate student's responsibility to determine the appropriate style used in his or her discipline for presentation of material derived from other sources and to adhere to it scrupulously in all written presentations. Where no special disciplinary style exists, that given in Kate L. Turabian's *A Manual for Writers of Term Papers, Theses, and Dissertations,* published by the University of Chicago Press, should be used.

University Ombud. The ombud investigates complaints from students, faculty, and administrative personnel that they have been unfairly dealt with in the normal channels of administrative process. An opportunity is thus provided for a personal appeal to an impartial official with broad perspective who has ready access at all levels to those involved in a grievance. The ombud is always available to receive complaints, inquire into the matters involved, and mediate or otherwise resolve the problem. However, the ombud does not become involved with the normal operations of established procedures as outlined in the *Graduate Student Manual,* except where they are not functioning as intended.

Confidentiality of Student Records

Procedures for the release and disclosure of student records maintained by the University are in large measure governed by state and federal laws. Where the law is silent, the University is guided by the principle that the privacy of an individual is of great weight and that as much information in a student's files as possible should be disclosed to the student upon request. A current or former student has the right to inspect or review official records, files, and data directly related to him or her. This right does not extend to applicants, those denied admission to the University, or those who were offered admission but did not enroll.

Some records not available to students are: letters of recommendation obtained or prepared before January 1, 1975; letters of recommendation which the student has waived his or her right to inspect; employment records of students as University employees; clinical, medical, counseling, or psychiatric records; parents' financial aid records; and campus law enforcement records.

A student may challenge the factual and objective elements of the content of student records, but not the qualitative and subjective elements of grading. If the student objects to certain items included in his or her personal records, a grievance procedure has been established. Ultimately, a Hearing Board on Student Confidential Records could render a decision.

Third parties do not have access to personally identifiable records or information pertaining to students without the written consent of students who specify the records to be released. Federal law requires that parents be considered third parties.

Detailed guidelines for the release and disclosure of information from student records are available from the Office of Student Life in the Memorial Union. They comply with the legal requirements of the Family Educational Rights and Privacy Act of 1974.

Notice of Change

Rules, regulations, dates, tuition, fees, the availability and titles of programs and areas of specialization, their administrative location, and courses set forth in this bulletin are subject to change without notice. Where a change in program requirements is made while a graduate student is currently enrolled, the student may elect to complete the program under the requirements in effect at the time of matriculation, or to shift entirely to the new requirements, but may not choose parts of each set. As a result of the ongoing reviews of all graduate programs, certain offerings and specializations may be deleted or restructured between editions of the *Graduate School Bulletin.*

DEGREE REQUIREMENTS

Each advanced degree awarded by the University requires as a minimum the successful completion of a specified number of approved credits of graduate study at the University and the passing of prescribed examinations. Credit hours for a master's or doctoral degree may include formal coursework, independent study, research, preparation of a thesis or dissertation, and such other scholarly activities as are approved by the candidate's program committee and the dean of the Graduate School.

It is the student's responsibility to know the calendar, regulations, and pertinent procedures of the Graduate School and to meet its standards and requirements. These are set forth in this bulletin, the *Graduate Student Manual,* the *Statement on Thesis Preparation,* and other publications, all of which are available to graduate students at the Graduate School Office.

These documents govern both master's and doctoral degree programs. The manual gives detailed information on responsibilities of major professors and program committees, examination procedures, preparation of theses and dissertations, academic standards, and the Graduate Student Academic Appeals System.

The requirements immediately following are *general requirements* for all graduate students. *Specific requirements* for individual programs are itemized in the section on Graduate Programs.

Program of Studies

The purpose of the program of studies is to ensure that students, at an early stage in their graduate study, organize coherent, individualized plans for their coursework and research activities. It is expected that the successful completion of the students' programs of studies along with collateral readings, research, etc., will enable them to demonstrate that they have achieved the high level of competence required of graduate students in their respective fields.

All degree candidates are required to prepare a program of studies with the guidance of their major professors (for master's degree programs) or of their program committees (for doctoral programs) in accordance with the guidelines in the *Graduate Student Manual.* After the program has been approved by the major professor for master's degree candidates or by the program committee

for doctoral candidates, the program of studies is submitted for approval to the dean of the Graduate School.

Course Numbering System

All regular graduate courses are numbered at the 500 and 600 levels. All 900-level courses are special graduate courses for which no graduate program credit is given. Courses numbered at the 400 level are for advanced undergraduates, but may, with approval and to a limited extent, be accepted toward meeting degree requirements at the master's level. For doctoral candidates who have completed the master's degree in the same field or one closely related, all program work must be at the 500 or 600 level.

Scholastic Standing

Graduate work is evaluated by letter grades. All grades earned will remain on the student's record and, unless the courses were approved for no program credit prior to registration, all unacceptable grades will be included in calculating the student's scholastic average.

A grade of C+ (2.33) or lower in courses numbered below the 500 level is considered a failing grade. In such cases of failure the course must either be repeated, if it is a required course, or else replaced by another course approved by the candidate's program committee and the dean of the Graduate School. When students receive more than one grade of C+ (2.33) or lower in courses below the 500 level, their graduate status is subject to review by the dean of the Graduate School.

Grades of C-, D, and F are failing grades in 500- and 600-level courses and require immediate review of the student's status. Courses failed at this level must be repeated, if they are required courses, or else replaced by other courses approved by the candidate's program committee and the Dean of the Graduate School.

The grades S (satisfactory) and U (unsatisfactory) will be used for courses of study involving research undertaken for the thesis or dissertation and for certain courses and seminars so designated. The letter I (incomplete) is used for excused unfinished work. Incomplete grades assigned to graduate students may be removed within one calendar year. If the grade of I (incomplete) is not removed within one calendar year, it will remain on the transcript but may not be used for program credit. Grades of S, U, and I are not included in the academic average.

To qualify for continuation of degree candidate status and for graduation, a cumulative average of B (3.00 on a 4.00 scale) in all work is required, except for courses meeting entrance deficiencies or approved for no program credit prior to registration in the course. At any time when the academic record indicates unsatisfactory performance, the student's status is subject to review. A student who fails to maintain a satisfactory grade point average or to make acceptable progress towards the degree may be dismissed as a graduate student.

Master's Degree Requirements

There are no major or minor area requirements for the master's degree. However, no degree can be awarded for the accumulation of credits without a planned program of study. Courses for the degree are expected to be concentrated in the candidate's field of interest and related areas to produce a well-developed and coherent program.

Requirements for the master's degree must be completed within a period of four calendar years, or seven calendar years with special permission of the department and the dean of the Graduate School if the study is done on a part-time basis. The master's degree may be earned through full- or part-time study or a combination of the two. Candidates must take at least 80 percent of the credits required for the degree at The University of Rhode Island.

Some departments offer both a thesis and a nonthesis option while others offer only one plan. Please refer to the chapter on Graduate Programs for specific information on each program. The general requirements for these options are as follows.

Thesis Option. The minimum requirements for a master's degree are: 1) the successful completion of 30 credits, including 6 thesis research credits; 2) at the discretion of the department, the passing of written comprehensive examinations toward the end of the coursework; 3) the submission of an acceptable thesis and the passing of an oral examination in defense of the thesis. Four copies of the thesis prepared in accordance with Graduate School requirements must be submitted to the Graduate School Office. A statement on preparation of theses is available from that office.

Nonthesis Option. Depending on departmental requirements, some master's degrees may be earned without a thesis. The minimum requirements for a nonthesis master's degree program are: 1) the successful completion of a minimum of 30 credits; 2) registration in advanced seminars, practicums, internships, or other experiences useful to the student's future professional career; 3) registration in one course which requires a substantial paper involving significant independent study; 4) the passing of a written comprehensive examination toward the end of the coursework. Some departments may also require a final oral examination.

Language. Although a language is not normally required for the master's degree, a student's major professor or thesis committee may require proficiency in a foreign language where appropriate for the subject chosen.

Professional Degree Requirements

Students should refer to the specific program requirements for professional degrees and consult with the appropriate dean or director.

Doctor of Philosophy Degree Requirements

The Doctor of Philosophy degree must be completed within seven years of the date when the student first enrolls as a candidate.

The requirements for the doctoral degree are: 1) the completion of a minimum of 72 credits of graduate study beyond the baccalaureate degree, of which a minimum of 42 credits must be taken at The University of Rhode Island; 2) fulfillment of the residence requirement of maintaining full-time residence for at least two consecutive semesters while acquiring the last 42 credits for the degree, but prior to taking the doctoral comprehensive examinations. Residence is interpreted as full-time attendance (9 credits or more) on campus or in the College of Continuing Education during a regularly scheduled semester. Full-time registration for both terms of a summer session counts as one semester of residence. With the exception of graduate assistants, instructors, research assistants, or the equivalent, no candidate for the doctorate may count part-time study toward satisfying this residence requirement unless a specific request for an exception, outlining the reasons and alternate method of satisfying the requirement, is approved by the candidate's doctoral committee and submitted together with the candidate's program of studies for the approval of the dean of the Graduate School; 3) the passing of a qualifying examination; 4) if required by the department, proficiency in one or more foreign languages and/or in an approved research tool; 5) the passing of a comprehensive examination; 6) the completion of a satisfactory dissertation; 7) the passing of a final oral examination in defense of the dissertation. The department in which the student studies for the doctoral degree may or may not require a master's degree preliminary to, or as part of, the regular course of study.

Qualifying Examination. This examination is intended to assess a student's potential to perform satisfactorily at the doctoral level. A student without a master's degree who is accepted as a doctoral candidate is expected to take a qualifying examination, usually after 24–30 credits have been completed. A student who holds a master's degree in the same or a closely related field is normally not required to take the examination. If an examination is required, it will be stipulated in the letter of admission.

Research Tool. Each department, in cooperation with the Graduate School, is authorized to formulate and to amend its own requirements and methods of testing for competency in research tools such as computer science, foreign language(s), or statistics. The department may, in turn, delegate this responsibility to the program committee for each individual doctoral candidate.

Comprehensive Examination. Each doctoral candidate shall take comprehensive examinations at or near but not later than 12 months after completion of the formal courses stipulated in the program of study. The examination is designed to assess the student's intellectual capacity and adequacy of training for scholarly research.

The comprehensive examination consists of two parts: written, requiring a minimum of eight hours; and oral, requiring not more than two hours. The student, with the approval of his or her program committee, applies to the Graduate School to take the examination. The oral examination committee includes the student's committee and two additional members of the graduate faculty appointed by the dean of the Graduate School. One of the additional members represents a field of study allied to that of the student's major. The candidate's major professor arranges for and chairs the examination. Unanimous approval by the examining committee is required for the passing of the comprehensive examination.

A candidate whose performance fails to receive unanimous approval of either examining committee may, with the committee's recommendation, be permitted one reexamination in the part or parts failed, to be taken no sooner than ten weeks and no later than one year after the initial examinations.

Final Oral Examination. This examination is a defense of the dissertation and is open to all members of the faculty and, generally, to all students. The examination, usually two hours long, is conducted by an examining committee comprised of the candidate's program committee and two additional graduate faculty members appointed by the dean of the Graduate School. One of the appointed members will be designated by the dean to chair the examination.

ADMISSION AND REGISTRATION

Unanimous approval of the examining committee is required for passing. If the candidate does not perform satisfactorily, the committee may recommend one reexamination under stated conditions.

Theses and Dissertations

For the oral defense, a sufficient number of completed copies of the thesis or dissertation, acceptable in form and substance to each member of the examining committee and the dean of the Graduate School, is required. At least ten working days prior to the proposed defense, the copies must be submitted to the Graduate School. At that time an additional copy must be placed on file in the Reserve Book Room of the Library.

Following a successful defense and after all changes and corrections have been made, four copies prepared in accordance with Graduate School and Library requirements must be submitted to the Graduate School Office. Doctoral candidates must submit an additional abstract, not exceeding 350 words.

Students are advised to consult the *Statement on Thesis Preparation and Instructions for Thesis Defense* available in the Graduate School Office and the most recent edition of Kate L. Turabian's *A Manual for Writers of Term Papers, Theses, and Dissertations* published by the University of Chicago Press.

Admission

Persons holding the baccalaureate degree and wishing to take graduate-level courses at the University may do so through admission to the Graduate School as degree candidates, or through postbaccalaureate work as nonmatriculated students. Admission to the Graduate School is based on academic qualifications and potential without regard to age, race, religion, sex, national origin, handicap, or sexual orientation, and discrimination against disabled and Vietnam era veterans.

A set of application materials is included in this bulletin. Additional application forms may be obtained from the Graduate Admissions Office, The University of Rhode Island, Kingston, RI 02881. Zip code should be included in the applicant's return address. Inquiries concerning particular degree programs or courses of instruction should be addressed to the appropriate department chairperson as listed in the Graduate Programs section of this bulletin.

Applications and credentials are to be submitted to the Graduate Admissions Office. Final decision rests with the dean of the Graduate School who, after obtaining the recommendation of the department concerned, notifies the applicant.

Where admission to a doctoral program is possible for those holding the bachelor's degree and meeting other requirements, the Graduate School reserves the right to offer admission only to the master's program while postponing a decision on admission to the doctoral program until at least a substantial portion of the master's work has been completed.

All applications must be accompanied by a $25 nonrefundable application fee. Simultaneous application to more than one department requires duplicate applications and credentials and separate application fees.

General deadlines for receipt of applications and all supporting documents are April 15 for September or summer session admission, and November 15 for January admission. As indicated in the Graduate Programs section of this bulletin, certain programs admit students only for September or have earlier deadlines. There is no assurance that applications completed after specified deadlines will be processed in time for enrollment in the desired semester. Admission is valid only for the term offered and must be reconsidered if a postponement is subsequently requested.

International Applicants. Applicants from foreign countries must complete the Test of English as a Foreign Language (TOEFL) with minimum scores of 500 for students applying for science programs and 550 for nonscience programs, unless a different minimum is listed under the admission requirements for the specific program. International application forms may be obtained from the Graduate Admissions Office. Inquiries from international students concerning nonimmigrant visas, housing, etc., should be sent to the Office of International Student Services.

Transfer Credit. Transfer credit may be requested for graduate work taken at other accredited institutions of higher learning. Such credits may not exceed 20 percent of the total credits required for the program. Doctoral candidates holding a master's degree in the same or a closely related area may request up to 30 credits. The transfer work must have been taken at the graduate level (equivalent to the 500 level or higher in The University of Rhode Island course-numbering system) and a passing grade earned at that institution. It must have been completed not more than five years prior to the date of request for transfer into a master's program (ten years for the doctoral program) and must have a clear and unquestioned relevance to the student's program of study. The request for transfer credit must have the approval of the student's

major professor and the dean of the Graduate School. If transfer credit is desired for work taken elsewhere after a graduate student is enrolled at this University, *prior approval* must be obtained from the dean of the Graduate School.

Degree Candidates. Applicants must forward to the Graduate Admissions Office two completed application forms, two official copies of transcripts of all previous college work sent directly by the issuing institutions, three letters of recommendation, and test scores in the appropriate nationally administered tests. Tests required for specific programs may be found in the Graduate Program section of this bulletin. The Graduate School cannot accept test scores (GRE, MAT, or GMAT) which were earned more than five years prior to the term of application. If test results exceed the five-year limit, applications must retake the examination.

To be accepted as a graduate degree candidate, applicants must have maintained an average of approximately B (3.00 on a 4.00 scale) or better in their undergraduate work and have satisfactory scores on the appropriate nationally administered test. Applicants with undergraduate averages below the B level may be admitted with submission of other evidence of academic potential, i.e., satisfactory performance in postbaccalaureate work, professional experience as evidenced by publications or letters of recommendation, and/or high scores in the standardized test referred to above. All students are expected to maintain a cumulative average of B (3.00) or better. Students who do not maintain a cumulative B (3.00) average will have their status reviewed and may be placed on provisional status, be suspended, or be dismissed. A student placed on provisional status must achieve a cumulative B (3.00) average within one semester (or nine credits, if part-time) or be subject to suspension or dismissal.

Advanced Standing. A maximum of 12 credit hours of work taken at The University of Rhode Island in nondegree status may be applied toward degree requirements if the student is later admitted to a degree program, but only with the recommendation of the student's program committee and the approval of the dean of the Graduate School. Advanced standing for work taken at another institution, or obtained by examination or equivalency, must also be included within this limit.

In certain cases, applicants who have been denied admission may be advised to take several courses in nondegree status (see the following) to provide a basis for later reconsideration of their applications. In such cases, these courses are usually regarded as though they were entrance deficiencies and are not accepted for advanced standing within minimum-credit programs of study.

Nonmatriculating (Nondegree) Status. Individuals holding a bachelor's degree who are not candidates for an advanced degree may take courses during the academic year or in the summer in nonmatriculating status. Normally, to take courses for personal satisfaction or professional advancement, postbaccalaureate students enroll in the College of Continuing Education. However, if the work is being taken to provide a basis for later consideration for admission to degree status it may be advisable to apply for nondegree status. Applicants for this status must file regular applications with statements of purpose and submit the required transcripts. However, letters of recommendation or scores on nationally administered tests are not required. Admission to nondegree status will establish a permanent file in the Graduate School Office and in the department, and permit advising of the student. Nonmatriculating students follow the same registration procedure as degree candidates. If nonmatriculating students later wish to be admitted to a degree program they must complete the regular admission procedure.

Nonmatriculating students do not have the privileges regularly enjoyed by degree candidates. For example, they may not preregister and their enrollment is subject to the accommodation of degree candidates wishing to take these courses. In addition, there is a limit to the number of courses taken in this status that may be used as advanced standing to satisfy degree requirements. Nonmatriculated students are not eligible for financial aid.

Registration

The responsibility for being properly registered rests with the student. Students must complete their registration within the time period announced by the University. The chairperson of the student's major department will assign an advisor to assist the new graduate student in planning a program.

Registration for each semester consists of three separate procedures: registering for course selections, paying fees, and obtaining a class program.

Registering for Course Selections. Students must obtain registration materials at the announced time and place. Currently enrolled students preregister in October for the spring semester and in March for the fall semester. Completed registration materials are submitted to the Office of the Registrar during the registration period according to the announced instructions.

New and transfer students will be instructed concerning registration procedures.

Paying Fees. Arrangements must be made with the Bursar for complete and timely payment of tuition and fees. Class programs will be issued only for those students who have registered for course selections and have satisfied payment requirements with the Bursar.

Obtaining a Class Program. Students may not attend classes without class programs. These are issued prior to the first day of classes according to instructions from the Office of the Registrar.

Drop and Add. Students are permitted to drop courses and to add courses with subsequent reassessment of fees (see page 19) during the first two weeks of classes. The final day to drop courses without a grade is midsemester. However, fees are not reassessed beyond the second week of classes.

Change of Address. It is the responsibility of the student to complete a change of address form in the Office of the Registrar whenever a change is made in the local, campus, or mailing address.

Summer Session. Although many graduate-level courses are offered during the summer session, the University does not guarantee that any particular course will be offered. The availability of individual faculty members to supervise research or to participate in comprehensive examinations and examinations in defense of theses or dissertations during the summer session varies from year to year. During the summer session, special arrangements must be made with both the Graduate School and the department for scheduling comprehensive examinations and thesis or disserta-

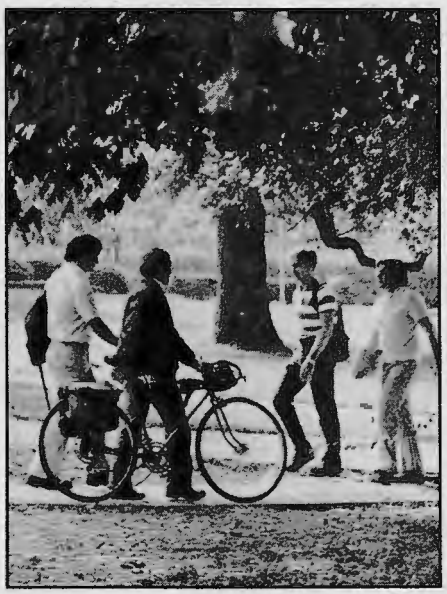
tion defenses. Graduate students must make prior individual arrangements for taking directed studies or special problems courses.

Time Limit and Continuous Registration. Graduate students are expected to complete their coursework and research within the four-year time limit prescribed for the master's degree and the seven-year time limit for the doctorate. Graduate students are expected to remain continuously enrolled, except for summer sessions which are optional, until they have completed all requirements and have received their degree. Students who do not register for coursework or research and who do not comply with the regulations governing leaves of absence or withdrawal must pay the continuous registration fee each semester until the degree has been awarded. The time limit for a degree program may be extended by applying to the dean of the Graduate School for legitimate reasons such as military service or serious illness. This request requires the endorsement of the student's major professor or department chairperson.

See the *Graduate Student Manual,* Section 4, for regulations regarding leaves of absence, notification requirements, and circumstances under which it will be assumed that graduate students have withdrawn from the University.

A student who does not register for a semester, or obtain approval for a leave of absence, will be considered as voluntarily withdrawn.

Full-Time and Part-Time Students. The normal full-time registration is 12 credit hours of study during a regular semester. Minimum full-time registration is nine credit hours during a regular semester and six credit hours during a summer session. Maximum registration of 15 credit hours during a regular semester may not be exceeded without prior written permission of the dean of the Graduate School, based on extraordinary circumstances. Credits in excess of 15 will be billed at the per-credit rate. Full-time registration is required of all international students and of all students holding fellowships, assistantships, full scholarships, and traineeships administered by the University. Students who do not meet the minimum full-time registration requirement are considered part-time students.



Off-Campus Activity. Students who wish to register for credits to be counted toward a degree, and who will be earning these credits through off-campus activities such as research or independent study at a national laboratory, are required to obtain prior approval of the dean of the Graduate School and to have these activities listed as part of their programs of study.

Intellectual Opportunity Plan (Pass–Fail Option). To allow graduate students to venture into new areas of knowledge without fear that their scholastic average will suffer, the Graduate Council has approved the Intellectual Opportunity Plan. (Please note that courses below the 400 level are automatically excluded from the scholastic average.) To be eligible for this option, the student's major professor or advisor must certify that the course or courses are outside the student's major field of study, are not entrance deficiencies, and are not specific requirements of, but are relevant to, the student's program. A maximum of four credits may be taken by the master's degree candidate and a maximum of eight credits, including any taken as a master's candidate, by the doctoral candidate.

Credit by Examination or Equivalent. In master's programs only, a maximum of six credits may be allowed for competency based on experience outside the traditional academic setting and demonstrated by examination or equivalent. This maximum of six credits must be included in the overall maximum of 12 credits allowed for advanced standing and transfer credit. See the *Graduate Student Manual,* Section 7.30, for details.

Audit. Courses may be audited with the approval of individual course instructors and by presenting an auditor's card obtained from the Office of the Registrar. An auditor receives no course grade; consequently an audited course does not count as part of the student's course load for registration purposes, does not appear on the transcript, and cannot count as work taken toward completion of residence requirements. A student must be enrolled in at least one other course to be permitted to audit a course.

Required Identification. In order to obtain a University ID card and to be certified for employment, students must have in their possession a photo identification card, such as a driver's license, and a certified copy of their birth certificate. A valid passport will serve both of these purposes.

FEES AND FINANCIAL AID

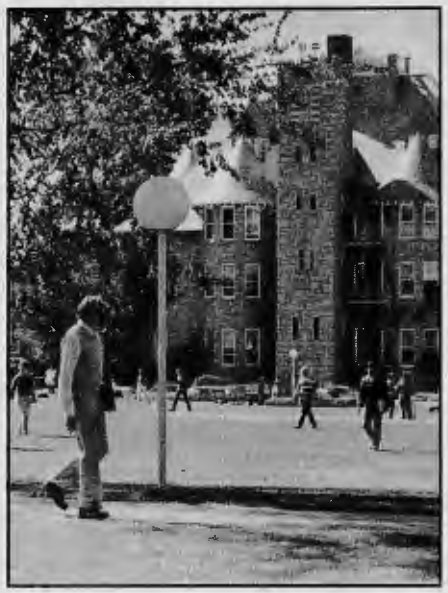
Charges and fees set forth in this bulletin are subject to change without notice.

Tuition and fees vary according to whether or not the student is a legal resident of the state of Rhode Island and according to full-time or part-time enrollment. All charges are payable by the semester and are due and payable upon receipt of the bill or by the due date indicated on the bill.

The dean of the Graduate School classifies each student admitted to the University as a resident or nonresident student on the basis of all relevant information available to him. A certificate of residence is included in this bulletin along with the application for admission. It must be filed by residents of Rhode Island and New England Regional Students; failure to file the affidavit will result in automatic classification as an out-of-state student. Forms for reclassification as a Rhode Island resident student are available in the Graduate School Office. A student may appeal the decision to the Board of Residence Review.

New England Regional Student Program. Under the provisions of the New England Regional Student Program for graduate students administered by the New England Board of Higher Education, the University charges a regional student rate (125 percent of Rhode Island resident tuition) to residents of other New England states who are matriculated graduate students in certain programs. The specific program must be one which is *not available* at the student's home-state institutions of higher education, and must have been declared open to regional students by The University of Rhode Island. Students must apply through the Graduate School and must file a certificate of residence signed by the clerk of the city or town where they claim legal residence. This form is included with the application at the back of this bulletin. Determination of regional status is made by the Graduate School which will inform the applicant of the final decision. If a student transfers to another program, the regional student status is automatically terminated. Where appropriate, the student may apply for regional student status in the new program.

Normally, these programs are listed in the New England Regional Student Program graduate-level booklet. In cases



where an apparently similar program of study is available at both institutions involved, residents of another New England state must obtain certification from the dean of the Graduate School of their home-state university that the program of study is not available within that state system. This certification will normally take the form of a statement by the chairperson of the relevant department endorsed by the graduate dean. Inquiries and requests for further information may be directed to the dean of the Graduate School at The University of Rhode Island or to the New England Board of Higher Education, 45 Temple Street, Boston, MA 02111.

Rhode Island Interinstitutional Exchange. Full-time students matriculated at one of the public institutions of higher education in Rhode Island may enroll for a maximum of seven credits of their full-time schedule per semester for study at one of the other public institutions at no additional expense. Each institution will determine and maintain the integrity of the degree to be awarded. Students will be subject to the course selection process applicable at the receiving institution. Summer session and continuing education registrants are not covered under this program. Students interested in this arrangement should contact the Office of the Registrar.

Tuition Waiver for Senior Citizens at Public Institutions of Higher Education. Any Rhode Island resident senior citizen who submits evidence of being 60 years of age, or over, will be allowed to take courses at any public institution of higher education in the state with the tuition waived. Admission into particular courses will be granted on a space-available basis and at the discretion of the receiving institution. All other costs of attendance are paid by the student.

Schedule of Fees. This schedule of fees is effective for the 1989–90 academic year. The University reserves the right to revise its schedule of tuition and fees without notice.

Full-time, One Academic Year

Students registered for 9–15 credits, graduate research assistants, and graduate assistants are considered full-time and are charged the following fees:

Tuition	
Rhode Island residents	$1,968.00
Regional students	2,460.00
Out-of-state residents	4,510.00
Registration fee	20.00
Graduate student assessment	20.00
Memorial Union fee	124.00
Health Services fee	200.00
Student Health Insurance Plan	226.00

Credits in excess of 15 will be billed at the per-credit rate listed for part-time registration. Enrollment at Kingston and CCE locations is combined when determining these fees. Dropping overload credit after the end of the add period does not reduce term bills.

Kingston and CCE Enrollment

All students who are full-time because of combined enrollment at both the College of Continuing Education and the Kingston campus (9 credits and over) are assessed the following fees at the standard full-time rate when enrolled in at least 5 credits on the Kingston campus: Memorial Union fee, Student Activity tax, Student Health Insurance Plan, Health Services fee. Students enrolled for less than 5 credits at the Kingston campus are charged the fees at the part-time rate. Dropping courses at either location after the end of the add period does not reduce term bills.

Health Service Fees

All full-time graduate students, all international students and their spouses, and all graduate assistants and graduate research assistants are required to participate in the University Health Services plan and accompanying Student Health

Insurance Plan. With the exception of international students and their spouses, the Student Health Insurance Plan may be waived if evidence of comparable coverage in another plan is provided and if the student completes, signs, and returns a waiver card to the insurance agent prior to the end of the add period (first two weeks of school). Unless the insurance is waived, the student will be billed. Waiver forms may be obtained directly from Health Services. Part-time students and spouses of students are eligible to participate in the health and insurance plans on an optional basis.

Part-time, One Semester

Students registered for 8 credits or less are charged the following fees. Students maintaining continuous enrollment and registered for no credit (CRG 999) are required to pay a fee of $114 per semester.

Tuition, per credit hour	
Rhode Island residents	$110.00
Regional students	137.00
Out-of-state residents	251.00
Registration fee	10.00
Graduate student assessment	1.00
Memorial Union fee, 5–8 credits	15.50
1–4 credits	7.75

Reassessment of Fees. Students are allowed to drop and add credits during the first two weeks of each semester (add period). Fees are reassessed and adjusted according to the credit enrollment and student status resulting from drop and add transactions processed by the Office of the Registrar during the add period. Following the add period, term bills are only reassessed for part-time students who add credits. The dropping of credits after the add period does not reduce term bills.

Application Fee. Twenty-five dollars must accompany each application for admission. See page 15 for application procedures.

Additional Fees. Students may be asked to make key deposits and to cover laboratory and other incidental expenses for specific courses. Students taking performance courses in music are charged an additional applied music fee each semester of $85 for MUS 050, $170 for MUS 231, 241, 242, 251, 261, 451, 461, 551, and 561 to cover the private lessons associated with these courses.

Students earning credit by examination must pay a fee of $40 per listing before it can be added to their transcript.

Master's degree candidates must pay a thesis-binding fee of $18, and doctoral candidates must pay dissertation-binding and microfilming fees of $72. These fees are due before candidates submit their dissertations for approval by the Graduate School.

Late Fees. A late registration fee of $15 for the first week during which registration falls, and $50 thereafter, is charged unless excused by the Office of the Registrar.

Remission of Fees. Tuition and the registration fee are paid from University or grant funds for holders of tuition scholarships, graduate assistantships, and graduate research assistantships (12 credits maximum per semester), and most fellowships. The students are required to pay all other fees including the Health Services and Student Health Insurance fees, Memorial Union fee, and the graduate student assessment. Tuition for students appointed to partial assistantships will be prorated for the period of the appointment. The student will be responsible for the remainder of the full-time tuition and fees. The same policy applies to assistantships terminated during the academic year.

Refunds. Refunds of payments made or credits against amounts due to the University shall be made to students who officially withdraw or take a leave of absence from the University according to the following scale: first two weeks, 80 percent; third week, 60 percent; fourth week, 40 percent; fifth week, 20 percent; after five weeks, no refund. The attendance period in which withdrawal occurs is counted from the first day of registration and includes weekends and holidays. Coverage under the Student Health Insurance Plan terminates when the student withdraws for any reason other than graduation or incapacitating disability. Students whose coverage has terminated for reason of withdrawal may request a prorata refund of their premium from the insurance company. (For further information refer to the current AETNA/URI Student Health Insurance Program brochure.)

Financial Aid

There are several forms of financial assistance available to graduate students. To be eligible for any form of assistance, the student must first be admitted as a degree candidate. Detailed information (stipends, allowances, tenure, etc.) on fellowships, scholarships, and assistantships is available from the Graduate School Office and is included in the *Graduate Student Manual.* Fellowships and scholarships are awarded by the dean of the Graduate School to students selected from nominations submitted by department chairpersons. Students are advised to request nomination for these awards by the chairperson of the department in which they plan to study or in which they are currently enrolled at the University.

Fellowships. Fellowships are awarded to graduate students in recognition of their achievement and promise as scholars. They are intended to enable students to pursue graduate studies and research without rendering any service to the University. Graduate fellows are required to be full-time students and may not engage in additional remunerative work without the specific advance approval of the dean of the Graduate School.

Special Fellowships are supported by various industrial firms, private foundations, and individuals, and are usually restricted to students in particular areas of study and research. The stipends and supplemental allowances of these fellowships are not uniform.

A limited number of *University of Rhode Island Graduate Fellowships* is awarded each year to promising students in doctoral programs. URI Fellows receive a stipend of $7,650 for the academic year and have tuition and the registration fee paid from University funds.

URI Fellows are responsible for the remaining fees. Those wishing to be considered for fellowships should complete their applications by February 1.

Graduate Assistantships and Graduate Research Assistantships. Assistantships are awarded to full-time graduate students to provide them with teaching and research training. Assistants may be required to provide service for up to 20 hours per week. Appointments are initiated by department chairpersons. To be eligible for such an appointment, students must first be admitted as degree candidates. Applications for assistantships should be submitted to the department chairperson by February 15. Appointments are announced about April 1.

Graduate Assistants assist, under supervision, with instructional and/or research activities of a department. Not more than ten hours per week will be in classroom contact. Graduate assistant stipends for the 1989–90 academic year range from $7,250 to $8,050, depending upon qualifications. In addition, tuition and the registration fee (12 credits maximum) are paid from University funds for each semester of the academic year of the appointment. The student is responsible for the remaining fees. Additional remuneration is given for any work done during the summer, although such work cannot be guaranteed. Stipends and tuition remissions for students appointed to partial assistantships will be prorated for the period of the appointment. The student will be responsible for the remainder of the full-time tuition and fees. The same policy applies to assistantships terminated during the academic year.

Graduate Research Assistants are assigned to individual research projects sponsored either by the University or by an outside agency. On supported research contracts and grants, the graduate research assistants are considered to be employed half-time (based on a 40-hour week). For this they normally receive a stipend ranging from $7,250 to $8,050 for nine months. In addition, tuition (12 credits maximum) and registration fee are paid in each semester of the academic year of the appointment. The student is responsible for the remaining fees. Additional remuneration is given for any work done during the summer months. Stipends and tuition remissions for students appointed to partial assistantships will be prorated for the period of the appointment. The student will be responsible for the remainder of the full-time tuition and fees. The same policy applies to assistantships terminated during the academic year.

Tuition Scholarships, which cover tuition and registration fee, are awarded by the dean of the Graduate School from University funds. These scholarships are awarded to qualified students demonstrating financial need. Application forms are available in the Graduate School Office.

Other Sources of Aid

There are many additional sources of financial aid available to students who qualify: scholarships from private organizations, clubs, labor unions, fraternities, sororities, and businesses; Vocational Rehabilitation financial support and Veterans Administration benefits, including survivor benefits. Students should apply directly to the source if they believe they qualify. The Graduate School Office has a copy of the current Grants Register for use within the office, as well as files on many different fellowship opportunities.

In addition, limited amounts of aid from federal and state sources are available through the Student Financial Aid Office. This office distributes money from various sources to help students with financial need. Need is defined as the difference between what it costs to attend URI and what the student and family can contribute from their financial resources, including all other sources of assistance. The student is expected to earn a portion of these resources. Only citizens, nationals, or permanent residents who have been accepted and are matriculated as URI graduate students are eligible. Special students and students attending only during the summer sessions are ineligible. The national Financial Aid Form (FAF) should be submitted to the College Scholarship Service in Princeton after January 1, but prior to March 1. For further information or copies of the forms, contact the Student Financial Aid Office in Roosevelt Hall. Telephone: 792–2314.

Federal Aid. *Carl Perkins Loan.* Graduate students may borrow up to $18,000, including any undergraduate loans. These loans have a simple interest rate of 5 percent annually. Interest does not accrue until six months after graduation or withdrawal. Minimum payments of $30 per month are required, and the repayment period may extend up to ten years.

College Work-Study Program. This federally supported program provides part-time employment during the school term and full-time employment during the vacation periods. The jobs may be either with University departments or with off-campus, nonprofit, nonsectarian, nonpolitical agencies. Other institutionally funded employment is also available. A list of these jobs is available in the Student Financial Aid Office.

Guaranteed Student Loan Program. Students may apply for loans through local lending institutions. Interest on loans, until six months after graduation or withdrawal, will be paid by the federal government. A simple interest rate of 8 percent annually is charged once the repayment period begins. Graduate students may borrow up to $7,500 a year, with a maximum of $54,750, including undergraduate loans.

PLUS/SLS Loans for Higher Education. Graduate students may apply for loans of up to $4,000 per year. A variable interest rate begins every year but cannot exceed 12 percent. Additional information may be obtained from local lending institutions.

University Aid. *Regular Student Employment.* Positions funded by the University are available to several hundred students, and are listed in the Student Financial Aid Office.

University Loans. Emergency loans ranging from $10–$100 are available to full-time students. These loans are short-term in nature (14–90 days) and can be made only when there are means of repayment. Application forms are available at the Student Financial Aid Office.

Veterans' Benefits. Information may be obtained from the veterans' liaison officer in the Office of the Registrar. All students receiving veterans' benefits are required to report to the veterans' liaison officer when withdrawing from or dropping any course, or when withdrawing from the University. Failure to do so will result in the termination of veterans' benefits.

Special Awards

URI Foundation. Income from a number of endowment funds is distributed annually. Each of the funds is used for a purpose specified by the donor. Further information may be obtained from the URI Foundation in Davis Hall.

Stanley Berger Memorial Fund. This scholarship is awarded by the Department of Psychology to a graduate student in clinical psychology.

Bertran M. Brown Endowment Fund. These funds are used for graduate student support in the Department of Chemistry.

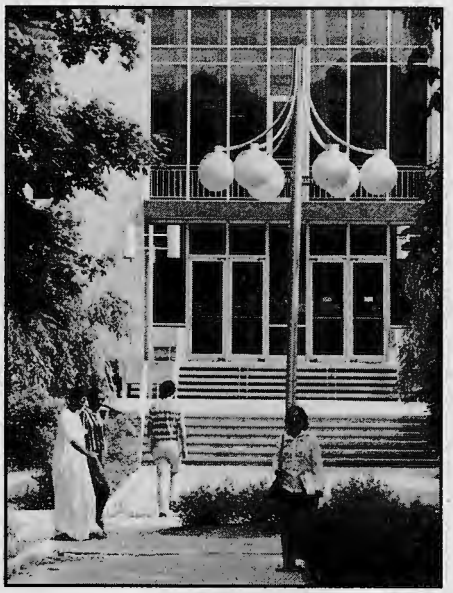
Catharine and Walter Eckman Memorial Scholarship. This scholarship is awarded to a graduate student in the humanities, including English, comparative literature, languages, history, philosophy, music, and political science. Recipients will be selected by the Graduate School Committee on Scholarships and Fellowships.

Joshua MacMillan Graduate Fellowship in Fisheries Oceanography. Annual fellowship awarded on thee basis of financial need to a master's or doctoral student with marked interest in fisheries science.

Arthur D. Jeffrey Memorial Scholarship. This scholarship is awarded to a graduate student in community planning on the basis of financial need.

Graduate Library School Scholarship. This scholarship is awarded to a student in the Graduate Library School. The recipient will be selected by the Director of the Graduate Library and Information Studies Program.

The L. Douglas Nolan Award. This award was established by L. Douglas Nolan for significant graduate student achievement in science. The recipient of this award is selected annually by the dean of the Graduate School based on nominations submitted by academic department chairpersons. The criteria for selection are given in the call for nominations. This award recognizes superior academic performance and research accomplishments during the course of graduate study. It includes a financial award of $500.



Graduate School of Oceanography (GSO) Alumni Endowment. These awards are made to deserving GSO students selected by the GSO Alumni Committee.

William R. Potter Chemistry Fund. These funds are awarded to doctoral students in pharmacy on the basis of academic achievement in chemistry. The recipient is selected by a College of Pharmacy committee.

Dr. and Mrs. James P. Reid Endowment Scholarship. This scholarship is awarded to a graduate student with high academic standing enrolled in the master's degree program in physical education. The recipient will be selected by the Reid Scholarship Committee.

Richard D. Wood Memorial Award for Excellence in Botany. This award is made to senior students entering graduate studies in botany on the basis of scholarship, character, academic integrity, and intellectual enthusiasm.

Policy on Satisfactory Academic Progress

The Education Amendments of 1980, P.L. 96-374, October 3, 1980, state that "a student is eligible to receive funds from federal student financial aid programs at an institution of higher education if the student is maintaining satisfactory progress in the course of study he or she is pursuing according to the standards and practices of that institution."

To maintain satisfactory progress as a graduate student at The University of Rhode Island for federal financial aid purposes, the student must be enrolled in a degree-granting program on at least a half-time basis (i.e., five credits) for each semester during which aid is received. The courses must be graduate level and applicable to the student's approved program of study. Master's degree candidates have eight semesters to complete degree requirements on a full- or part-time basis. Students who are not in residence during the academic year terms and who have received special permission from the dean of the Graduate School have 14 summer sessions in which to complete requirements. Two summer sessions totaling at least five credits will be considered one part-time semester; two summer sessions totaling nine credits will be considered one full-time semester. Doctoral degree candidates have 14 semesters in which to complete their degrees, regardless of whether they matriculate with an earned master's degree.

Master's and doctoral students who have completed all course requirements including thesis research shall be considered to be making satisfactory progress at least at the half-time rate if they are registered for at least one thesis credit or continuous registration. All students must be enrolled for consecutive semesters until graduation unless an official leave of absence or interruption of study has been approved. If students exercise neither the leave of absence nor interruption of study option and fail to register, they are considered to have voluntarily withdrawn.

For further information, see the *Graduate Student Manual* or consult the Student Financial Aid Office. Telephone: 792–2314.

GRADUATE PROGRAMS

This section must be read in conjunction with the preceding sections on Degree Requirements and on Admission and Registration. The specific admission and program requirements listed in this section are included within the general requirements set forth in the preceding sections, and do not reduce those general requirements. For example, scores on the General (Aptitude) Tests of the Graduate Record Examination (GRE) are required of all applicants unless another nationally administered test such as the Graduate Management Admission Test (GMAT) or the Miller Analogies Test (MAT) is specified. Scores on the GRE Subject (Advanced) Tests are required only where specified.

Please note that the specific program requirements given on the following pages are minimum requirements. For example, additional course credits may be required for individual candidates whose academic background is insufficient. All graduate-level courses are also described in this chapter. Undergraduate courses numbered at the 400 level, permitted for graduate credit in some cases, are described in the *Undergraduate Bulletin* and are listed here for reference only. Courses at the 500 level comprise the majority of coursework between the bachelor's and the master's degrees. Those at the 600 level are advanced graduate courses. The 900-level courses are special types of graduate courses for which no degree credit is given. They include courses offered to remedy deficiencies as well as workshops, institutes, and courses offered one time only by visiting faculty.

Courses with two numbers, e.g., ASP 501, 502, indicate a year's sequence and the first course is either a prerequisite for the second or at least the two cannot be taken in reverse order without special permission. Parentheses after a course number enclose either the old course number or, in cases of multiple listings, the departments and numbers under which the course is also offered.

The roman numeral indicates the semester the course will normally be offered; some courses, however, are offered only in alternate years and a few less frequently. The *Schedule of Courses* issued by the Office of the Registrar during the October and March registration period must therefore be consulted to determine which courses will be offered in the following semester. The arabic numeral indicates the credits; distribution of class hours each week is in parentheses. The instructor's name follows the course description.

Course Codes

ACC Accounting
ADE Adult and Extension Education
AAF African and Afro-American Studies
AVS Animal and Veterinary Science
APG Anthropology
AMS Applied Mathematical Sciences
ASP Aquacultural Science and Pathology
ART Art
ARH Art History
AST Astronomy
BCP Biochemistry and Biophysics
BOT Botany
BSL Business Law
CHE Chemical Engineering
CHM Chemistry
CVE Civil and Environmental Engineering
CMD Communicative Disorders
CPL Community Planning
CLS Comparative Literature Studies
CSC Computer Science
CNS Consumer Studies
DHY Dental Hygiene
ECN Economics
EDC Education
ELE Electrical Engineering
ENG English
EST Experimental Statistics
FIN Finance
FST Fisheries Science and Technology
FSN Food Science and Nutrition
FRN French
GEL Geology
GER German
GRK Greek
HIS History
HED Home Economics Education
HCF Human Development, Counseling, and Family Studies
IME Industrial and Manufacturing Engineering
INS Insurance
ITL Italian
JOR Journalism
LAT Latin
LRS Labor and Industrial Relations
LAR Landscape Architecture
LSC Library Science
LIN Linguistics
MGT Management
MGS Management Science
MAF Marine Affairs
MKT Marketing
MTH Mathematics
MCE Mechanical Engineering and Applied Mechanics
MTC Medical Technology
MCH Medicinal Chemistry
MIC Microbiology
MUS Music
NRS Natural Resources Science
NES New England Studies
NUR Nursing
OCE Ocean Engineering
OCG Oceanography
PHC Pharmaceutics
PCG Pharmacognosy
PCL Pharmacology and Toxicology
PHP Pharmacy Practice
PHL Philosophy
PED Physical Education
PHT Physical Therapy
PHY Physics
PLS Plant Sciences
PSC Political Science
PSY Psychology
RCR Recreation
RDE Resource Development Education
REN Resource Economics
RTH Respiratory Therapy
RUS Russian
SOC Sociology
SPA Spanish
TMD Textiles, Fashion Merchandising, and Design
THE Theatre
URB Urban Affairs
WMS Women's Studies
WRT Writing
ZOO Zoology

The availability of programs of study and areas of specialization listed in this section, as well as their administrative location, requirements, and titles, are subject to change without notice.

The University experience is designed to provide the successful student with a range of knowledge and skills which can be utilized in a variety of ways after graduation provided that they are combined with appropriate motivation and initiative. Options available to students vary from the traditional liberal education to programs which are heavily professionally oriented. Successful completion of any course of study at the University, however, does not guarantee that the student will find either a specific kind or level of employment.

Students who are interested in the career opportunities related to particular programs of study are encouraged to discuss their interests with the appropriate department chairperson or director of graduate studies as listed in this bulletin, with the deans of the Graduate School, or with the staff of the Office of Career Services. Students who are uncertain about their career choice are invited to inquire about the services offered by the Counseling Center.

Accounting
M.S.

Graduate Faculty

Chairperson: Professor Spencer J. Martin, Ph.D., 1970, University of Illinois; C.P.A.
Director of Graduate Studies: Professor Henry R. Schwarzbach, D.B.A., 1976, University of Colorado; C.P.A.
Professor Joseph P. Matoney, Jr., Ph.D., 1973, Pennsylvania State University; C.P.A.
Professor Richard Vangermeersch, Ph.D., 1970, University of Florida; C.P.A., C.M.A.
Assistant Professor Carol J. McNair, Ph.D., 1986, Columbia University; C.M.A.

Master of Science

The program leading to the Master of Science in accounting is designed to meet the educational requirements for entry into the accounting profession and for advanced study for students with an undergraduate degree in accounting.

The master's program is designed for students with a variety of educational backgrounds and professional interests. Applicants with a bachelor's degree in accounting from an accredited institution can complete the program of study in one year. Applicants with no prior education in business will need to spend two years in full-time study. The course of study is divided into two parts. Part one is a foundation in business and accounting that is required for all students without a bachelor's degree in business. The student's undergraduate record is evaluated, and foundation courses are waived when a student has undergraduate equivalents. The second phase of the program allows the students to build on their accounting foundation and develop a high level of theoretical knowledge and a sound understanding of accounting principles and techniques. During the second part of the program the student selects an area in which to specialize. The following areas are available: professional accountancy, tax accounting, management accounting, and controllership.

Admission requirements: undergraduate grade point average of approximately B or above and a score at the 50th percentile or above on the GMAT Examination are expected. The GMAT score and the undergraduate quality point average are not the sole criteria for admission. However, those with undergraduate quality point averages of less than B or with lower than 50th percentile scores on the GMAT have a reduced probability of admission. Applicants for whom English is not the native language will be expected to demonstrate proficiency in written and oral communications (TOEFL score of 575 or above), or they may be required to correct deficiencies by taking selected courses for no program credit.

Program requirements: from 30 to 60 credits, depending on undergraduate program. A written comprehensive examination is required in the nonthesis option.

All 500- and 600-level courses offered by the departments in the College of Business Administration are open to matriculated graduate students only.

ACC Courses
Accounting

413 Contemporary Accounting Issues *(II, 3)*
415 Accounting Computer Systems *(I and II, 3)*
431 Advanced Accounting *(I, 3)*
443 Federal Tax Accounting *(II, 3)*
461 Auditing *(I, 3)*

535 Advanced Problems in Accounting *(II, 3)* General and specialized accounting problems that constitute the subject matter of CPA examinations. *(Lec. 3) Pre: 431.* Staff

544 Taxation of Corporations and Shareholders *(II, 3)* Examination of the tax laws affecting corporations and shareholders. Includes law governing corporate formation, liquidating and nonliquidating distributions, reorganizations, taxes on corporation accumulations, and planning of transactions for tax compliance and minimization. *(Lec. 3) Pre: 443 or permission of instructor.* Matoney

548 Accounting for Noncommercial Entities *(II, 3)* Principles and practices of fund accounting as applied to municipalities, educational institutions, hospitals, and similar organizations, with particular emphasis on municipal records and statements. *(Lec. 3) Pre: permission of instructor.* Staff

562 Advanced Auditing *(II, 3)* Statements on auditing standards, auditing electronic systems, auditor's reports, statistical sampling in auditing, regulations of SEC, and cases in auditing. *(Lec. 3) Pre: 461.* Staff

610 Financial Accounting *(I and II, 4)* Covers basic accounting principles, accounting systems design, and financial statement analysis. Includes principles of responsibility accounting and budgeting. *(Lec. 4) Pre: mathematics or statistics, ECN 590, MGS 520 and 530.* Staff

611 Managerial Accounting *(I or II, 3)* Determination of accounting information for the purposes of decision making, control, and evaluation with emphasis on decision models using accounting information. *(Lec. 3) Pre: 610, MGS 520 and 530.* Staff

618 Current Accounting Theory *(I, 3)* Critical examination of accounting theory and practice to develop research techniques with emphasis on financial accounting. *(Lec. 3) Pre: 311 and 312.* Staff

619 Current Accounting Theory *(II, 3)* Critical examination of accounting theory and practice with respect to cost and managerial accounting. *(Lec. 3) Pre: 321.* Staff

641 Federal Taxation Seminar *(II, 3)* Examination and discussion of the laws and rationale affecting the federal taxation of individuals as well as an introduction to research in taxation. *(Lec. 3) Pre: 311 and graduate standing in accounting.* Staff

643 Federal Taxes and Business Decisions *(II, 3)* The course focuses on tax law and its effect on business decisions. Cases are employed and primary emphasis is on income tax planning, although estate and gift taxes are explored. *Pre: 610.* Staff

644 Partnership, Estate, and Gift Taxation *(I, 3)* Examination of the tax laws affecting partnerships, estates, and gifts. Includes income and wealth taxation with an emphasis on tax avoidance through effective planning. *(Lec. 3) Pre: 641.* Matoney

645 Advanced Topics in Federal Taxation *(II, 3)* Examination of tax laws governing sales and exchanges, accounting methods, accounting changes, deferred compensation, tax shelters, and recent developments in the tax laws. *(Lec. 3) Pre: 443 or 641.* Matoney

646 Seminar in Tax Research, Policy, and Planning *(II, 3)* Examination of the methodology of tax research, the principles and procedures involved in tax planning, and the procedures involved in dealing with the IRS. *(Sem. 3) Pre: 641 or equivalent.* Matoney

661 Seminar in Auditing *(I, 3)* Readings and discussions on auditing standards, procedures, programs, working papers, internal control, and current auditing topics. *(Lec. 3) Pre: 311 and graduate standing in accounting.* Staff

681 Accounting Policy *(II, 3)* Development of accounting policy with respect to managerial planning and control. Emphasis on analytical evaluation of cases with major research project. *(Lec. 3) Pre: 618, graduate standing, and completion of all foundation courses.* Staff

691, 692 Directed Study in Accounting *(I and II, 1–3 each)* Advanced work under the supervision of a staff member and arranged to suit the individual requirements of the student. *(Lec. 1–3) Pre: permission of instructor.* Staff

693 Internship in Accounting *(I and II, 3)* Participation in management and/or problem solving under the supervision and guidance of a sponsoring agency with evaluation by the College of Business Administration. *Pre: proposal acceptance by the College of Business Administration, no previous internship credit, graduate standing. S/U credit.* Staff

Animal Pathology

See Fisheries, Aquaculture, and Pathology on page 50.

Animal and Veterinary Science

See Fisheries, Aquaculture, and Pathology on page 50.

Applied Mathematical Sciences

Ph.D. (Interdepartmental)

This interdepartmental program is sponsored by the Departments of Computer Science and Statistics, Industrial and Manufacturing Engineering, Management Science, and Mathematics. It is administered by a coordinating committee selected from the graduate faculty.

Coordinating Committee: Edward A. Grove (chairperson), Seetharama Narasimhan, Leonard M. Kahn, R. Choudary Hanumara, William D. Lawing, David L. Freeman

Graduate Faculty

Professor Edward J. Carney, Ph.D., 1967, Iowa State University
Professor Rodney D. Driver, Ph.D., 1960, University of Minnesota
Professor Edward A. Grove, Ph.D., 1969, Brown University
Professor R. Choudary Hanumara, Ph.D., 1968, Florida State University
Professor James F. Heltshe, Ph.D., 1973, Kansas State University
Professor Jeffrey E. Jarrett, Ph.D., 1967, New York University
Professor Russell C. Koza, Ph.D., 1968, Rensselaer Polytechnic Institute
Professor Gerasimos Ladas, Ph.D., 1968, New York University
Professor James T. Lewis, Ph.D., 1969, Brown University
Professor Pan-Tai Liu, Ph.D., 1968, State University of New York, Stony Brook
Professor Dennis W. McLeavey, D.B.A., 1972, Indiana University; C.P.I.M. (Fellow)
Professor Richard Mojena, Ph.D., 1971, University of Cincinnati
Professor Seetharama Narasimhan, Ph.D., 1973, Ohio State University
Professor Charles D. Nash, Ph.D., 1959, Ohio State University
Professor Edward Nichols, Ph.D., 1958, Purdue University
Professor S. Ghon Rhee, Ph.D., 1978, Ohio State University
Professor Emilio O. Roxin, Ph.D., 1959, University of Buenos Aires
Professor Oved Shisha, Ph.D., 1958, Hebrew University
Professor Robert C. Sine, Ph.D., 1962, University of Illinois
Professor E. Ramnath Suryanarayan, Ph.D., 1961, University of Michigan
Professor Donald W. Tufts, Sc.D., 1960, Massachusetts Institute of Technology
Professor Ghasi Ram Verma, Ph.D., 1957, Rajasthan University
Associate Professor Gerard M. Baudet, Ph.D., 1978, Carnegie Mellon University
Associate Professor Frank M. Carrano, Ph.D., 1969, Syracuse University
Associate Professor Norman J. Finizio, Ph.D., 1972, Courant Institute of Mathematical Sciences, New York University
Associate Professor James G. Kowalski, Ph.D., 1975, University of Notre Dame
Associate Professor Edmund A. Lamagna, Ph.D., 1975, Brown University
Associate Professor William D. Lawing, Jr., Ph.D., 1965, Iowa State University
Associate Professor Lewis J. Pakula, Ph.D., 1972, Massachusetts Institute of Technology
Associate Professor David M. Shao, Ph.D., 1970, State University of New York, Buffalo
Assistant Professor Diane Johnson, Ph.D., 1983, University of Oregon
Assistant Professor Eugene A. Kohlbecker, Ph.D., 1986, Indiana University
Assistant Professor Roger W. Peck, Ph.D., 1983, University of Texas, Dallas
Professor Emeritus William J. Hemmerle, Ph.D., 1963, Iowa State University
Professor Emeritus Peter F. Merenda, Ph.D., 1957, University of Wisconsin

Specializations

Applied mathematics, computer science, operations research, statistics, and applied probability.

Doctor of Philosophy

Admission requirements: GRE with advanced test in undergraduate field, bachelor's degree in computer science, engineering, mathematics, management science, physical sciences, statistics, or equivalent. With permission, GMAT may be substituted for GRE by applicants with business background. Applicants with entrance deficiencies may be accepted subject to taking certain undergraduate courses in addition to the graduate program requirements. Although a person with a bachelor's degree may be admitted, this program is designed principally for people who have a master's degree.

Program requirements: dissertation, 54 credits beyond the bachelor's degree including MTH 435, 436, two courses selected from MTH 462, 513, 515, 535, 545, 561, and 641, and three core courses in each of two of the following areas: applied mathematics, basic analysis, numerical analysis, computer science, operations research, statistics, and applied probability. (A maximum of 30 credits may be granted for a master's degree in a closely related area.) Comprehensive examination in core areas and reading proficiency in one foreign language. The Ph.D. qualifying examination is required of students admitted without the master's degree.

AMS Courses
Applied Mathematical Sciences

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Audiology

M.A., M.S.

See Speech–Language Pathology on page 98.

Biochemistry and Biophysics

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor George C. Tremblay, Ph.D., 1965, St. Louis University
Professor Joel A. Dain, Ph.D., 1957, Cornell University
Professor Harold W. Fisher, Ph.D., 1959, University of Colorado
Professor Karl A. Hartman, Ph.D., 1962, Massachusetts Institute of Technology
Assistant Professor John J. Dougherty, Ph.D., 1978, University of Wisconsin
Assistant Professor Dennis E. Rhoads, Ph.D., 1982, University of Cincinnati

Specializations

Neurochemistry; action of peptide hormones on neuromodulation; biochemistry of olfaction; nonenzymatic glycation of proteins; glycolipid metabolism; galactose metabolism; structure and function of hormone receptors; protein phosphorylation; mammalian cell culture; electron microscopy of nucleic acid and protein complexes; spectroscopic studies of the structures and interaction of nucleic acids and proteins;

metabolism of nitrogenous constituents in mammalian tissues; regulation of metabolism.

Master of Science

Admission requirements: GRE (advanced test in chemistry or biology) and a bachelor's degree in some field of science or engineering including two semesters each in organic chemistry with laboratory, biological sciences, and calculus, and one semester in physics. Students may be accepted with deficiencies which must be made up without program credit.

Program requirements for all M.S. candidates: BCP 435, 521, 541, 581, 582, 1 credit of 695 or 696, and 3 credits in an additional 500-level course exclusive of special topics or research. All full-time students are expected to be continuously registered for BCP 695, 696 (Seminar), but no more than 1 credit can be used for program credit. Thesis option: a minimum of 24 credits (exclusive of thesis credits) including the above requirements and a thesis. Nonthesis option: a minimum of 36 credits including the above requirements, BCP 651 or 652, and the written master's examination.

Doctor of Philosophy (Biological Sciences)

Admission requirements: same as for master's degree candidates; M.S. degree not required to enroll in Ph.D. program. Qualifying examination required of all Ph.D. candidates.

Program requirements: BCP 435, 521, 541, 581, 582, a total of 3 credits in BCP 695, 696, and at least 6 credits of additional BCP coursework at the 500 level, exclusive of special topics or research. All full-time students are expected to be continuously registered for BCP 695, 696 (Seminar), but no more than 3 credits can be used for program credit.

BCP Courses
Biochemistry and Biophysics

401 (or MIC 401) Quantitative Cell Culture *(I, 3)*

403 (or MIC 403) Introduction to Electron Microscopy *(I, 2)*

405 (or MIC 405) Electron Microscopy Laboratory *(I, 2)*

412 Biochemistry Laboratory *(II, 3)*

421 (or MIC 421) Cell Biology and Cancer *(I, 3)*

435 Physical Chemistry for Life Sciences *(I, 3)*

491, 492 Research in Biochemistry and Biophysics *(I and II, 1–6 each)*

503 Electron Microscopy
See Microbiology 503.

505 Laboratory in Electron Microscopy
See Microbiology 505.

521 Physical Biochemistry *(II, 3)* The use of diffusion, sedimentation, viscosity, electrophoresis, isoelectric focusing, chromatography, and spectroscopy, (including linear and circular dichroism) to determine the size, shape, structure, interactions, and molecular weight of biological macromolecules. *(Lec. 3) Pre: 435 or equivalent. In alternate years. Next offered spring 1990.* Hartman

523, 524 Special Topics in Biochemistry and Biophysics *(I and II, 1–3 each)* Advanced work arranged to suit the individual needs of the student. Lecture and/or laboratory according to the nature of the problem. *Pre: permission of chairperson. May be repeated for a maximum of 12 credits. S/U credit for 524.* Staff

541 Laboratory Techniques in Biochemistry *(I, 3)* Potentiometric titration and buffers, spectroscopy (UV, visible, and IR), protein assays, radioisotopes, gel electrophoresis, chromatography (thin-layer, ion-exchange, and high-performance), and ultracentrifugation. *Pre: general chemistry, organic chemistry, and credit or concurrent enrollment in at least one semester of biochemistry.* Hartman

542 Proteins: Purification and Characterization *(II, 3)* Use of techniques for protein purification and activity studies. Laboratories involve enzymology, chromatography, investigation of soluble and membrane-bound receptors, gel electrophoresis and silver staining, thin-layer electrophoresis and autoradiography. *(Lec. 1, Lab. 6) Pre: 311 or 581 and permission of instructor.* Dougherty and Rhoads

551 Topics in Biochemistry for the Clinical Scientist *(I, II, or SS, 3)* Description of the major components of biochemistry as it relates to the medical sciences. Major concepts include molecular genetics, regulatory biochemistry, and medically related applied biochemistry. *Offered every third year.* Staff

572 Plant Biochemistry
See Plant Sciences 572.

581 General Biochemistry I *(I, 3)* First semester of a two-semester course on the principles of biochemistry. Topics include: bioenergetics, protein structure, enzymology, glycolysis, the tricarboxylic acid cycle, and oxidative phosphorylation. *(Lec. 3) Pre: CHM 228 and 229.* Dougherty and Rhoads

582 General Biochemistry II *(II, 3)* Second semester of a two-semester course on the principles of biochemistry. Topics include: photosynthesis, membranes, hormones, metabolism, the biosynthesis of DNA, RNA, and proteins. *(Lec. 3) Pre: CHM 228 and 229.* Dougherty, Rhoads, and Tremblay

583 Metabolism *(I, 3)* Intensive study of metabolic pathways of carbohydrates, lipids, and nitrogenous compounds; their interrelationships. Effects of hormonal and nutritional status on activity of these pathways. *(Lec. 3) Pre: 581, 582, and/or permission of chairperson. In alternate years.* Dain

584 Membrane Biochemistry *(II, 3)* Review of model systems for biochemical, physical, and chemical studies of cell membranes. Discussion of current research directed at a molecular understanding of membrane structure and function. *(Lec. 3) Pre: credit or concurrent enrollment in 582 or permission of instructor. In alternate years. Next offered 1990–91.* Rhoads

585 Recent Advances in Receptor Research *(I, 1)* Discussion of current research literature about receptors for hormones, pheromones, neurotransmitters, and other biological signals. Consequences of receptor activation will also be discussed. *(Lec. 1) Pre: 311 and permission of instructor. May be repeated.* Dougherty or Rhoads

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

622 Advanced Electron Microscopy
See Microbiology 622.

624 Advanced Electron Microscopy Laboratory
See Microbiology 624.

651, 652 Research in Biochemistry and Biophysics *(I and II, 3 each)* Students are required to outline a research problem, conduct necessary literature survey and experimental work, and present the observations and conclusions in a substantial written report. *(Lab. 6) Pre: graduate standing.* Staff

695, 696 Seminar in Biochemistry and Biophysics *(I and II, 1 each)* Presentation of selected topics from current literature or progress in thesis research, as assigned by the instructor. *S/U credit.* Dougherty and Rhoads

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

991 The Grant Proposal *(I, 2)* Identifying sources of support for research. Planning, presenting, and defending the objectives, rationale, background, significance, and budget of the research proposal. *(Lec. 2) Pre: doctoral standing in the biological or biomedical sciences, at least 24 credits of graduate-level coursework, and permission of instructor. In alternate years. Next offered 1990–91.* Rhoads and Tremblay

Botany
M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Robert G. Sheath, Ph.D., 1977, University of Toronto
Professor Luke S. Albert, Ph.D., 1958, Rutgers—The State University

Professor Roger D. Goos, Ph.D., 1958, University of Iowa
Professor Paul E. Hargraves, Ph.D., 1968, College of William and Mary
Professor Marilyn Harlin, Ph.D., 1971, University of Washington
Professor Theodore J. Smayda, Dr. Philos., 1967, University of Oslo
Professor Elijah Swift V, Ph.D., 1967, The Johns Hopkins University
Associate Professor Keith T. Killingbeck, Ph.D., 1976, University of North Dakota
Associate Professor Richard E. Koske, Ph.D., 1971, University of British Columbia
Associate Professor John P. Mottinger, Ph.D., 1968, Indiana University
Assistant Professor Joanna F. Norris, Ph.D., 1982, Michigan State University
Research Assistant Professor Glen B. Thursby, Ph.D., 1983, The University of Rhode Island
Adjunct Professor Richard Steele, Ph.D., 1967, University of Washington
Adjunct Assistant Professor Paulette Peckol, Ph.D., 1980, Duke University
Professor Emeritus Carl H. Beckman, Ph.D., 1953, University of Wisconsin

Specializations

Aquatic botany (marine and freshwater), cell biology, genetics and cytogenetics, mycology, phycology, plant development, plant ecology, plant molecular biology, plant physiology, plant taxonomy.

Master of Science

Admission requirements: GRE including advanced test and undergraduate major in the sciences. Candidates lacking undergraduate courses in organic chemistry, physics, mathematics through introductory calculus, and fundamental courses in biological sciences may be required to make up deficiencies without graduate credit.

Applications should be completed by April 15.

Program requirements: thesis and BOT 581, 582.

Doctor of Philosophy (Biological Sciences)

Admission requirements: same as for master's degree, which is normally required. Qualifying examination required for those accepted without the master's degree.

Applications should be completed by April 15.

Program requirements: dissertation; BOT 581, 582. Comprehensive examination will require competency in major areas of botany.

BOT Courses

Botany

418 Marine Botany *(II, 3)*
419 Freshwater Botany *(I, 3)*
432 Mycology: Introduction to the Fungi *(I, 4)*
437 (or ZOO 437) Fundamentals of Molecular Biology *(I, 3)*
453 (or MIC 453) Cell Biology *(II, 4)*
454 Genetics Laboratory *(I, 3)*
455 (or ZOO 455) Marine Ecology *(I, 3)*
457 (or ZOO 457) Marine Ecology Laboratory *(I, 1)*
465 Phycology: An Introduction to the Algae *(II, 3)*
490 Modern Techniques in Botanical Sciences *(I and II, 2)*

511 Special Readings in Developmental Plant Anatomy *(I, 3)* Intensive tutorial work, research, and reading on ontogeny of plant structures and morphogenetic mechanisms. *Pre: graduate standing and permission of instructor. Concurrent audit of 311 required. Offered on demand.* Staff

512 Morphology of Vascular Plants *(I, 3)* Comparative survey of development, form, and anatomy of extinct and extant vascular plants and modern interpretation of evidence concerning their interrelationships. *(Lec. 2, Lab. 2) Pre: 311 or equivalent. In alternate years.* Staff

521 Recent Advances in Cell Biology See Microbiology 521.

522 Plant Molecular Biology *(I, 4)* Analysis of gene expression in plants including topics such as choloroplast DNA, mitochondrial DNA, transgenic plants, and symbiotic genes. Laboratory includes cloning, restriction mapping, and hybridization. Emphasis on research literature. *(Lec. 2, Lab. 4) Pre: 352, BCP 311, or permission of instructor. In alternate years.* Norris

524 Methods in Plant Ecology *(II, 3)* Methods in analysis of vegetation and microenvironments. Emphasis on quantitative techniques in analysis of vegetation, soil, and microclimate; techniques in physiological ecology. *(Lec. 2, Lab. 3) Pre: 111 and 262 (or ZOO 262) or equivalent; EST 412 recommended. In alternate years. Next offered 1989–90.* Killingbeck

534 Physiology of the Fungi *(II, 3)* Life processes of fungi with particular emphasis on chemical composition, organic and mineral nutrition, toxic and stimulating agencies, and metabolism. Also stresses phenomena of variation of growth and sporulation as affected by various environmental factors. *(Lec. 2, Lab. 2) Pre: 432 or permission of instructor. In alternate years. Next offered 1990–91.* Koske

542 Medical Mycology *(II, 3)* Fungi pathogenic for humans and animals. *(Lec. 1, Lab. 4) Pre: 432 or MIC 201 or 211 or permission of instructor. In alternate years. Next offered 1990–91.* Goos

546 Seminar in Plant Stress Physiology *(II, 1–2)* Readings, discussion, and analysis of current literature with emphasis on biochemical and genetic aspects of responses. Students electing two credits will write review papers. *(Lec. 1) Pre: one course in plant physiology and one course in biochemistry. In alternate years. Next offered 1990–91.* Albert

551 Seminar in Aquatic Botany *(I, 1)* Readings and discussion on current research involving algae and other aquatic plants. *(Lec. 1) Pre: permission of instructor. May be repeated.* Harlin and Sheath

554 Cytogenetics *(I, 4)* Comparisons of various types of crossing-over, chromosomal abberations and their effects, mutation, and other cytogenetic pheonomena in fungi and higher organisms. Laboratory studies of meiosis in maize, identification of chromosomes, and induced rearrangements. *(Lec. 2, Lab. 4) Pre: 352, 453, or permission of instructor.* Mottinger

555 Algal Cell Biology *(II, 3)* Fine structure and metabolism of various algal taxa. Emphasis on carbon metabolism, nuclear and cell division, reproduction, and motility. Project required. *(Lec. 2, Lab. 2) Pre: 355 and 453 or equivalent, or permission of instructor. In alternate years.* Sheath

562 Seminar in Plant Ecology *(II, 2)* Recent topics and investigations pertinent to plant ecology. Library research, oral presentation of reports, and group discussions. *(Lec. 2) Pre: 262 (or ZOO 262) or equivalent or permission of instructor. May be repeated.* Killingbeck

579 Advanced Genetics Seminar See Zoology 579.

581, 582 Botany Seminar *(I and II, 1 each)* Preparation and presentation of papers on subjects in selected areas relating to botany. Required of graduate students majoring in botany. *(Lec. 1) S/U credit.* Staff

590 Botanical Techniques *(I, 1)* Current research techniques in the botanical sciences. Includes short-term participation in several ongoing research programs and an overnight, weekend field trip. *(Lab. 3) Pre: graduate standing or permission of instructor.* Staff

591, 592 Botanical Problems *(I and II, 1–3 each)* Special work arranged to meet the needs of individual students who are prepared for and desire advanced work in botany. *(Lec. 1–3, Lab. 2–6) Offered only by arrangement with staff.* Staff

593 Special Topics *(I and II, 1–3 each)* Covers the following specialized areas of botany: a) recent advances in mycology, b) physiological ecology of marine macroalgae, c) nutrient ecology of plants, and d) ecology of fungi. *Pre: permission of instructor. May be repeated for a maximum of 9 credits.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

661 Phytoplankton Taxonomy See Oceanography 661.

663 Phytoplankton Physiology
See Oceanography 663.

664 Phytoplankton Ecology
See Oceanography 664.

667 Advanced Phytoplankton Seminar
See Oceanography 667.

691, 692 Botanical Problems *(I and II, 1–6 each)* Special work to meet the needs of individual students who are prepared to undertake special problems. *(Lec. 3 or Lab. 6) Pre: permission of chairperson.* Staff

693, 694 Research in Botany *(I and II, 3 each)* Assigned research; subject matter to be arranged with a faculty member with the approval of the chairperson. *(Lab. 6)* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

930 Workshop in Botany Topics for Teachers *(I and II, 0–3 each)* Especially designed for teachers of biology. Basic topics of botany from an advanced or pedagogical perspective. *Pre: teacher certification.* Staff

Business Administration
M.B.A.

Graduate Faculty

Dean, College of Business Administration: Robert P. Clagett, M.S., 1967, Massachusetts Institute of Technology
Associate Dean and Director of MBA Program: Professor Robert A. Comerford, Ph.D., 1976, University of Massachusetts

Accounting
Chairperson: Professor Spencer J. Martin, Ph.D., 1970, University of Illinois; C.P.A.
Professor Joseph P. Matoney, Jr., Ph.D., 1973, Pennsylvania State University; C.P.A. (Rhode Island)
Professor Henry R. Schwarzbach, D.B.A., 1976, University of Colorado; C.P.A.
Professor Richard Vangermeersch, Ph.D., 1970, University of Florida; C.P.A. (Rhode Island)
Assistant Professor Carol J. McNair, Ph.D., 1986, Columbia University

Business Law
Associate Professor Andrew Laviano, J.D., 1965, New York University School of Law
Assistant Professor John Dunn, J.D., 1977, Boston College Law School
Assistant Professor Charles Hickox, J.D., 1979, Washington University

Finance and Insurance
Chairperson: Associate Professor Gordon H. Dash, Jr., D.B.A., 1978, University of Colorado
Professor S. Ghon Rhee, Ph.D., 1978, Ohio State University
Associate Professor Rosita P. Chang, Ph.D., 1981, University of Pittsburgh
Associate Professor Blair M. Lord, Ph.D., 1975, University of California
Associate Professor Henry R. Oppenheimer, Ph.D., 1979, Purdue University
Assistant Professor Michael McNamara, Ph.D., 1988, University of Nebraska
Assistant Professor Akio Yasuhara, Ph.D., 1982, The Ohio State University
Assistant Professor Chin-Jen Lie, M.A., 1981, Georgia State University, Atlanta

Management
Chairperson: Professor Clay V. Sink, Ph.D., 1968, Ohio State University: C.A.M.
Professor Norman Coates, Ph.D., 1967, Cornell University
Professor Robert A. Comerford, Ph.D., 1976, University of Massachusetts
Professor George deLodzia, Ph.D., 1969, Syracuse University
Professor Craig E. Overton, Ph.D., 1971, University of Massachusetts
Professor Charles T. Schmidt, Jr., Ph.D., 1968, Michigan State University
Associate Professor John B. Cullen, Ph.D., 1977, Columbia University
Associate Professor Richard W. Scholl, Ph.D., 1980, University of California, Irvine
Assistant Professor Laura L. Beauvais, Ph.D., 1986, University of Tennessee
Assistant Professor Elizabeth A. Cooper, Ph.D., 1985, University of Akron
Assistant Professor C.N. Hetzner, Ph.D., 1985, University of Massachusetts
Assistant Professor Diane M. Disney, M.A.T., 1965, Duke University; M.B.A., 1977, The University of Rhode Island; Ph.D., Brandeis University
David Beretta, Chairman of the Board, Uniroyal, Inc. (retired); B.S. 1949, The University of Rhode Island; Executive in Residence

Management Science
Chairperson: Professor Russell C. Koza, Ph.D., 1968, Rensselaer Polytechnic Institute
Professor Charles P. Armstrong, Ph.D., 1973, University of Arizona
Professor Frank S. Budnick, D.B.A., 1973, University of Maryland
Professor Jeffrey E. Jarrett, Ph.D., 1967, New York University
Professor Chai Kim, Ph.D., 1973, University of Pittsburgh
Professor Dennis W. McLeavey, D.B.A., 1972, Indiana University; C.P.I.M. (Fellow)
Professor Richard Mojena, Ph.D., 1971, University of Cincinnati
Professor Seetharama Narasimhan, Ph.D., 1973, Ohio State University
Professor Randolph F.C. Shen, Ph.D., 1964, University of Illinois
Associate Professor Roy Ageloff, Ph.D., 1975, University of Massachusetts
Associate Professor Alan B. Humphrey, Ph.D., 1965, North Carolina State University
Associate Professor Paul M. Mangiameli, Ph.D., 1979, Ohio State University
Associate Professor Stuart Westin, Ph.D., 1983, University of Massachusetts
Assistant Professor Shaw K. Chen, M.A., 1979, National Taiwan University
Assistant Professor Maling Ebrahimpour, Ph.D., 1986, University of Nebraska

Marketing
Chairperson: Professor M. Ven Venkatesan, Ph.D., 1965, University of Minnesota
Professor Albert J. Della Bitta, Ph.D., 1971, University of Massachusetts
Professor Nikhilesh Dholakia, Ph.D., 1975, Northwestern University
Professor Ruby Dholakia, Ph.D., 1976, Northwestern University
Professor Eugene M. Johnson, D.B.A., 1969, Washington University
Professor Greg J. Lessne, Ph.D., 1983, University of North Carolina, Chapel Hill
Professor Richard R. Weeks, D.B.A., 1966, Washington University
Associate Professor Carol F. Surprenant, Ph.D., 1981, University of Wisconsin
Assistant Professor Jean L. Johnson, Ph.D., 1988, University of Nebraska

Specializations

Finance, insurance, management science, marketing, organizational management, international management, international sports management, health care administration.

Master of Business Administration

The Master of Business Administration (MBA) program prepares students for executive and administrative positions in business, government, and nonprofit organizations. The program is offered on the Kingston campus for full-time and part-time students, and in the evening through the College of Continuing Education in Providence for part-time students. Candidates may begin the program in June, September, or January of each year.

In addition, an M.B.A. for Executives may be completed in 23 months by participating in a program which meets on Fridays and Saturdays at the W. Alton Jones Campus. A group of 20–25 experienced managers (7–10 years of management experience) follows a curriculum which emphasizes computer applications, human relations, organizational behavior, financial analysis, and other areas useful to the effective manager. Applications to the dean of the Graduate School should specify the MBA program and indicate on which campus study is to be undertaken.

Admission requirements: Graduate Management Admissions Test (GMAT), a statement of purpose, three letters of recommendation, and transcripts of all previous undergraduate or postbaccalaureate work are required. Work experience is valued. Applicants for whom English is not the native language will be expected to score 575 or above on the TOEFL. The GMAT score and

undergraduate quality point average are not the sole criteria for admission. However, those with undergraduate quality point averages of less than B or those with less than 50th percentile scores on the GMAT have a low probability of admission.

Program requirements: nonthesis program normally requires a maximum of 54 credits. Of these, 9 credits are designated "prerequisite courses" and are necessary to provide the basic tools for successful graduate study in administration: ECN 590, MGS 520 and 530. These courses would ordinarily be waived based on previous college-level study (as approved by the program director in consultation with the appropriate chairpersons). If MGS 520 or 530 is waived, the student must take an elective in place of the waived course. If ECN 590 is waived, the program is reduced by 3 credits. The 51-credit standard program is composed of 33 credits of required courses: ACC 610; BSL 600; FIN 601, 660; MGS 500, 600, 620, 640; MGT 630, 681; MKT 601; plus 18 credits of electives. Of the required courses, the following may be waived (with the recommendation of the appropriate chairperson and the MBA program director, and the approval of the dean of the Graduate School) based on significant prior college-level study in the appropriate field (usually multiple courses in the field from an AACSB-accredited program): ACC 610; BSL 600; FIN 601; MGS 500, 600, 620, 640; MGT 630; and MKT 601. Of the 18 credits of electives, at least 9 credits must be in a single field designated as the specialization.

For the specializations listed here, the courses indicated are either required or recommended, *in addition to the required MBA courses.* Other electives may be used to complement the courses specified for each track, but such choices are subject to approval by the track coordinator and the MBA director.

Finance. (Coordinator: Professor S. Ghon Rhee) Six tracks are offered: Corporation Finance (FIN 602, 641, 652); Bank Financial Management (FIN 632, 633, 641); Investment Management (FIN 622, 625, 641); International Finance (ECN 538, FIN 641, 652); Futures and Options (FIN 420, 625, 641); Risk Management and Insurance (INS 510, FIN 632, 641).

Health Care Administration. (Coordinator: Professor Russell C. Koza) Concepts associated with the design, implementation, and evaluation of administrative and clinical health systems are studied. The financial and economic interactions between consumers and providers of health care, and public and private prepayment and insurance programs are also examined. To concentrate in health care administration students must select at least 3 courses (9 credits) from the following: MGS 630, 664, 685, 686, PHP 651 or 652.

International Management. (Coordinator: Professor Norman Coates) Study of the problems and processes of managing the multinational corporation in an interdependent, global environment. While the required course track consists of 9 credits (MGT 655, MKT 651, FIN 652 or LRS/PSC 521), students are encouraged to take supplemental interdisciplinary courses in the historical, cultural, social, political, economic, or linguistic differences in administration.

International Sports Management. (Coordinator: Professor Robert A. Comerford) This specialization is designed for study of the problems, theories, and practice of managing sports-oriented organizations and functions. It presents students the opportunity to augment the general administrative core of the MBA program with additional courses related to sports activities on an international scale. Students specializing in international sports management will be required to participate in a 3-credit sports management internship (MGT 693 or 694–Internship in Management, Marketing, Finance, Management Science, or Accounting) arranged through the MBA director, the specialization coordinator, and the Institute for International Sport or another appropriate agency. Students must also take PED 551 and select, with approval of the MBA program director or the specialization coordinator, at least 6 credits of physical education or recreation courses from the following list: PED 560K, 560N, 578, 582, and RCR 485. Additional electives in international topics may be selected from: LRS or PSC 521, business languages (GER 421, ITL 480, FRN 480, SPA 421), MGT 655, FIN 652, MKT 651, and MGT 656.

Management. (Coordinator: Professor Clay V. Sink) Four tracks are available: Labor Relations (Coordinator: Professor Charles T. Schmidt, Jr.) LRS 542 or 543 (not both), 541, 545; Personnel Administration and Labor Relations (Coordinator: Associate Professor Richard Scholl) Three of the following: MGT 641, LRS 542 or 543 (not both), LRS 541, MGT 640; Entrepreneurship and Small Business Management (Coordinator: Professor Robert A. Comerford) MGT 480 or 482, BSL 460, MKT 615 or ACC 611; General Administration (Coordinator: Professor George deLodzia) MGT 626, 670, 695, or 696.

Management Science. (Coordinator: Professor Jeffrey Jarrett) This specialization allows study of the applications of mathematics, statistics, and computer systems to the management of organizations along with the function of production and operations management. Tracks may be tailored to the needs and backgrounds of students, and approved courses in manufacturing engineering, economics, computer science and statistics, or mathematics may be substituted, with prior approval of the coordinator or chairperson and the MBA program director. Students must select at least 3 of the courses in their preferred track with no more than 2 from the 400 level. Production and Operations Management: MGS 445, 450, 458, 681, 684; Managerial Statistics: MGS 445, 450, 470, 475, 601, 602, 630, 683,; Management Information Systems: MGS 630, 605, and one of the following—MGS 483, 484, 485, or 488; Operations Research for Management: MGS 445, 475, 683, 684.

Marketing. (Coordinator: Professor Eugene Johnson) The marketing specialization includes two tracks. Marketing Management: MKT 611, 615, 661. This track gives students the opportunity to study essential elements of marketing beyond the fundamentals covered in the core marketing course, MKT 601. Advertising and Marketing Research: MKT 611, 615, 631. This track emphasizes the fundamentals of marketing research, advertising, and promotion practices.

For students with a B.S.B.A. degree from an AACSB-accredited program, the MBA program of study will comprise a maximum of 14 courses and a minimum of 36 credits. Ordinarily, this will be achieved through the waiving of sufficient courses and credits from the 27 credits previously described as waivable (subject to the review process described). For students with a B.S.B.A. from an accredited program not having sufficient required courses and credits waived, elective courses will be appropriately reduced (subject to review and approval).

All 500- and 600- level courses offered by departments in the College of Business Administration are open to matriculated graduate students only.

Doctor of Philosophy

The Department of Management Science is a sponsor of the Ph.D. program in Applied Mathematical Sciences (see page 24).

General Information

In addition to the University's Academic Computer Center, business students have access to four other computer facilities: the Dennis W. Callaghan Microcomputer Lab, the Computer-Integrated Manufacturing Lab, the college's general computer facility, and a smaller computer laboratory at the College of Continuing Education (see page 6). These facilities are available to both daytime and evening students six days a week.

Accounting Courses

See listing under Accounting, page 23.

BSL Courses
Business Law

442 Property Interests *(II, 3)*
450 Consumer Law and Legislation *(I, 3)*
460 Law and the Entrepreneur *(II or SS, 3)*

501 Law and Accounting *(I, 3)* Introduction to CPA law exam, question and answer techniques, coverage of most accounting-

related legal subjects currently included on the CPA exam. *(Lec. 3) Pre: 600 or permission of chairperson.* Staff

600 Legal Environment of Business *(I and II, 3)* Introduction to legal and court system as it relates to business. Coverage includes both substantive rules and procedural rules of law in the civil and administrative law fields with emphasis on business, regulation, social issues, and ethics. *(Lec. 3) Pre: MGT 630 and graduate standing.* Laviano

691 Directed Study in Business Law *(I and II, 1–3)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. 1–3) Pre: permission of instructor.* Staff

FIN Courses
Finance

***401 Advanced Financial Management** *(I or II, 3)*
420 Speculative Markets *(I or II, 3)*
***425 Portfolio Theory and Management** *(I or II, 3)*
***433 Bank Financial Management** *(I or II, 3)*
***442 Real Estate Finance** *(I or II, 3)*
***452 Multinational Finance** *(I or II, 3)*
***491, 492 Directed Study** *(I and II, 3 each)*

601 Financial Management *(I and II, 4)* Functions and responsibilities of financial managers. Examination of financial issues, both internal to the firm and arising from interaction with the financial system. Financial statement analysis, structure, valuation, markets, capital budgeting, working capital. *(Lec. 4) Pre: ACC 610, ECN 590, MGS 520 and 530.* Staff

602 Advanced Financial Management *(I or II, 3)* Case studies and selected readings emphasizing the application of financial theory and analytical techniques to financial management. *(Lec. 3) Pre: 601 or equivalent.* Staff

622 Security and Investment Analysis *(I or II, 3)* Analysis of the problems of investing funds and managing investments. Use of the latest investment theories and their implementation via quantitative techniques will be explored. *(Lec. 3) Pre: 601 or equivalent.* Staff

625 Advanced Portfolio Theory and Security Analysis *(I or II, 3)* An examination of advanced theories and practices in portfolio building and maintenance. Issues related to security price behavior are also examined. *(Lec. 3) Pre: 540 or 601 or equivalent.* Staff

632 Financial System and Markets *(I or II, 3)* An analysis of the effects of the financial system on individual financial markets. Emphasis on examination of the behavior of money, stock, bond, and mortgage markets. *(Lec. 3) Pre: 601 or equivalent.* Staff

633 Depository Institutions and Financial Management *(I or II, 3)* Study of the financial decisions facing the management of depository institutions. Current financial practices and problems explored. Models for bank managers will be considered. *(Lec. 3) Pre: 601 or equivalent.* Staff

641 Advanced Financial Theory *(I or II, 3)* Analysis of the theoretical framework for corporate decision making related to financial planning, capital budgeting decisions, dividend policy, and capital structure decisions. Emphasis on current research developments. *(Lec. 3) Pre: 601 or equivalent.* Staff

652 Advanced International Financial Management *(I or II, 3)* Analysis of issues relevant to the international financial manager. The financial operations of multinational enterprises are examined through both the theoretical and case approach. *Pre: 601 or equivalent.* Staff

660 Managerial Economics *(I and II, 3)* The applications of economic theory and methodology to business problems. *(Lec. 3) Pre: 601, MGS 600, 620, and 640.* Staff

671 Seminar in Finance *(I or II, 3)* Independent research. Individual topics based on readings and research interests of the students. *(Lec. 3) Pre: 601.* Staff

691, 692 Directed Study in Finance *(I and II, 1–3 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. 1–3) Pre: permission of instructor.* Staff

693, 694 Internship in Finance *(I and II, 3 each)* Participation in management and/or problem solving under the supervision and guidance of a sponsoring agency with evaluation by the College of Business Administration. *Pre: proposal acceptance by College of Business Administration, no previous internship credit, and graduate standing. S/U credit.* Staff

INS Courses
Insurance

414 Advanced Commercial Property and Liability Insurance *(II, 3)*
433 Social Insurance *(I, 3)*
471 Topics in Insurance *(II, 3)*
491, 492 Directed Study *(I and II, 3 each)*

510 Risk and Insurance *(I, 3)* Nonspeculative business and personal risks and their treatment through insurance. Discussions will include the application of insurance to risks arising from life, health, property, and liability contingencies. *(Lec. 3)* Staff

686 Public Policy Issues in the Health System
See Management Science 686.

691, 692 Directed Study in Insurance *(I and II, 1–3 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. 1–3) Pre: permission of instructor.* Staff

693, 694 Internship in Insurance *(I and II, 3 each)* Participation in management and/or problem solving under the supervision and guidance of a sponsoring agency with evaluation by the College of Business Administration. *Pre: proposal acceptance by College of Business Administration, no previous internship credit, and graduate standing. S/U credit.* Staff

MGT Courses
Management

402 Leadership and Motivation *(I or II, 3)*
407 Organization and Management Theory *(I and II, 3)*
408 Organization Development and Change *(I or II, 3)*
410 Business Policy *(I and II, 3)*
422 Labor Law and Legislation *(II, 3)*
431 Advanced Management Seminar *(I or II, 3)*
453 International Dimensions of Business *(I, 3)*
480 Small Business Management *(II, 3)*
482 Entrepreneurship *(I, 3)*
491, 492 Special Problems *(I and II, 3 each)*

530 Management Theory and Practice *(II, 2)* Management applied to business; objectives, policies, organizational staffing, and control; production; personnel; behavioral science applications; the role of quantitative methods. *(Lec. 2)* Staff

626 Organizational Behavior *(I and II, 3)* Incorporates the insights gleaned from the disciplines of psychology, sociology, anthropology, and the social sciences of politics, economics, and history in the study of the behavior of organizations and of their principal actors. *(Lec. 3) Pre: 630 or equivalent.* Staff

627 Advanced Organizational Theory and Behavior *(I and II, 3)* Previous knowledge of classical and traditional management thought used to provide concepts, analytical approaches, and skills for understanding how behavioral sciences influence complex organizational systems. *(Lec. 3) Pre: 626.* Staff

630 Organizational Theory and Behavior *(I and II, 4)* Management applied to business objectives, policies, organizational staffing and control. Interpersonal dynamics in organizational settings. Role of human resource management. Emphasis on individual and structural factors affecting decision making. *(Lec. 4) Pre: graduate standing.* Staff

635 Consulting and Management Practice *(I or II, 3)* Review of the theory and practice

*These courses may not be taken for graduate credit by students in the College of Business Administration.

of effective consulting and development of consultation skills. *(Lec. 3) Pre: 630 or permission of instructor.* Coates

638 Seminar in Management *(I or II, 3)* Class discussion of typical cases, original research work in the field of management with discussion of data collected and analyzed by individual students. *(Lec. 3) Pre: permission of chairperson.* Staff

639 Advanced Topics in Management *(I or II, 3)* Integrated approach to problems in major areas of business management with emphasis on administrative and executive viewpoint. *(Lec. 3) Pre: permission of chairperson.* Staff

640 Compensation Administration *(I or II, 3)* Compensation and performance appraisal systems. Theory and techniques used to determine job worth. Special issues in compensation management, such as relating pay to performance through appraisal techniques and pay compression. *(Lec. 3) Pre: 630.* Staff

641 Human Resource Development *(I or II, 3)* Techniques used in procurement and development of human resource. Planning through recruitment, selection, and placement to training and development. Integration of HRD process with organizational strategic plans. *(Lec. 3) Pre: 630.* Staff

655 International Business Management *(I, 3)* Examines the problems and characteristics of international management by focusing on the role of the multinational corporation in a cross-cultural setting. *(Lec. 3) Pre: 630 or equivalent.* Staff

656 Japanese Business Systems *(I or II, 3)* A comparative study of Japanese business management systems by means of readings, case studies, and lectures. Focus on management practices in Japanese firms and problems of coping with environmental factors in Japan and the United States. *(Lec. 3) Pre: 630 or permission of the instructor.* Coates

657 International Comparative Management and Culture *(I or II, 3)* An interdisciplinary course which examines the effects of culture on managerial behavior and decision making. *(Lec. 3) Pre: 630.* Coates or Cullen

670 Business Environmental Analysis *(II, 3)* Advanced analysis of increasingly complex interrelationships between the business organization and its environment. Emphasis on conceptual foundations of business and the impact of contemporary sociopolitical issues on management decision making. *(Lec. 3) Pre: 630 or equivalent.* Staff

681 Administrative Policy and Decision Making *(I and II, 3)* Review of the functional areas of marketing, production, finance, economics, accounting, quantitative methods, organizational theory, interpersonal relationships, control and motivation systems, and communications. Includes the MBA written comprehensive examination according to Graduate School requirements. *(Lec. 3) Pre: all MBA foundation courses or undergraduate equivalents and a minimum of 21 MBA credits at the 600 level including MGT 630, MKT 601, FIN 601, and ACC 610.* Staff

691, 692 Directed Study in Management *(I and II, 1–3 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. 1–3) Pre: permission of instructor.* Staff

693, 694 Internship in Management *(I and II, 3 each)* Participation in management and/or problem solving under the supervision and guidance of a sponsoring agency with evaluation by the College of Business Administration. *Pre: proposal acceptance by the College of Business Administration, no previous internship credit, and graduate standing. S/U credit.* Staff

695 Managerial Skills Development *(I, II, and SS, 3)* Assessment, feedback, and development of managerial skills; leadership, group decision making and problem solving, negotiation, making presentations, giving feedback, listening. *Pre: 630.* Staff

696 Strategic Decision Making *(I, II, SS, 3)* Development of the skills and competencies in strategic thinking; use of critical analysis in the diagnosis of organizational and management problems. Serves as foundation for policy course and case method. *Pre: graduate standing.* deLodzia and Hetzner

MGS Courses
Management Science

445 Managerial Application of Simulation *(II, 3)*
450 Forecasting: Computer Applications *(I or II, 3)*
458 Integrated Production Logistics Systems *(II, 3)*
460 Management of Quality Control: Computer Applications *(I, 3)*
465 Advanced Topics in Management Science: Deterministic Models *(II, 3)*
466 Advanced Topics in Management Science: Probabilistic Models *(II, 3)*
470 Managerial Decision Support Systems *(II, 3)*
475 Bayesian Statistics in Business *(I or II, 3)*
483 Business Applications Programming *(I, 3)*
484 Management Systems Analysis and Design *(II, 3)*
485 Management of Databases *(I, 3)*
486 Advanced Programming and Information Structures *(II, 3)*
488 Business Software Development Project *(II, 3)*
491, 492 Special Problems *(I and II, 3 each)*

500 Computing for Management *(I and II, 2)* Computer concepts and programming in a high-level language such as BASIC, FORTRAN, PASCAL. Emphasis on computing as an administrative and analytical tool for applications in management. Includes use of software packages. *(Lec. 2 for one-half semester, first half) Graduate credit for non-MBA students only if 600 is completed.* Staff

520 Mathematical Methods for Management *(I and II, 3)* Fundamental mathematical methods applied to the understanding and solution of managerial problems. Topics include the solution of systems of linear equations, differential calculus, and related areas. *(Lec. 3) Graduate credit for matriculated M.B.A. and M.S. in accounting students.* Staff

530 Statistical Methods for Management *(I and II, 3)* Introductory methods of statistics applied to the understanding and solution of business problems. Topics include concepts of business-decision parameters, classical and subjective probability, probability distribution, inference, sample size problems, regression, and index numbers. *(Lec. 3) Graduate credit for matriculated M.B.A. and M.S. in accounting students only.* Staff

600 Information System Concepts *(I and II, 2)* Concepts, procedures, and managerial issues dealing with information and decision support systems. Topics include hardware and software; business systems; systems analysis, design, and implementation. *(Lec. 2 for one-half semester, second half) Pre: 500, 520, 530 or equivalent.* Staff

601, 602 Advanced Management Statistics *(I and II, 3 each)* Theory and application of regression and correlation analysis, analysis of variance and experimental design, and other multivariate data analyses. *(Lec. 3) Pre: 530 or permission of instructor.* Staff

605 Business Microcomputer Applications *(I, 3)* Microcomputer technology and applications in business. Hardware, software, selection of microcomputer systems, and use of commercial software packages. Student projects and microcomputer laboratory sessions required. *(Lec. 3) Pre: 500, 520, 530, 600 or equivalent.* Staff

620 Quantitative Methods for Management *(I and II, 2–3)* Survey of principal operations research/management science models. Linear programming, network, and other mathematical programming models; simulation, decision analysis, and other probabilistic models. *(Lec. 2 for one-half semester, first half) Pre: 500, 520, 530 or equivalent.* Staff

630 Management Statistics with SAS and Personal Computer Software *(II, 3)* Second course in statistical analysis for MBA students. Introduces SAS computer languages and personal software. Regression, business

experimental designs, time series, business index numbers, decision theory. *(Lec. 3) Pre: 530 or equivalent.* Staff

640 Production and Operations Management *(I and II, 2)* The management of manufacturing and service operations. Topics include: flow processes, inventories, scheduling, capacity, and operations strategy. *(Lec. 2 for one-half semester, second half) Pre: 530 or permission of instructor.* Staff

664 Health Information Systems *(I or II, 3)* Concepts associated with the design, implementation, management, and evaluation of administrative and clinical health information systems. *(Lec. 3) Pre: 500 or equivalent or permission of instructor.* Armstrong, Koza, and Humphrey

671 Methods of Business Research *(I and II, 3)* An understanding of research methodology and the culmination of such methodology into a term project. *(Lec. 3) Pre: 530 or equivalent and permission of chairperson.* Staff

681 Operations Management in Service Organizations *(I or II, 3)* Problems facing operations managers of service organizations are examined. Topics include: flows through services systems, forecasting service demand, capacity planning for service organizations, and scheduling service operations. *(Lec. 3) Pre: 640 or permission of instructor.* Staff

683 Business Decision Theory *(I or II, 3)* A statistical analysis of managerial decision making under uncertainty. Bayesian statistical inference and subjective probability are stressed. Comparisons between Bayesian method and classical statistics are discussed, and applications to business problems are emphasized. *(Lec. 3) Pre: 520, 530, or equivalent.* Staff

684 Advanced Mathematical Programming Methods in Management *(II, 3)* Introduction to integer, nonlinear, and dynamic programming. Emphasis on application of modern mathematical optimization techniques in single-stage and multiple-stage management decision problems. *(Lec. 3) Pre: 520 and 620 or equivalent.* Staff

685 Health: Financial Management and Insurance *(I, 3)* Financial and economic analysis of the interactions between consumers and providers of health care, and public and private prepayment and insurance programs. *(Lec. 3)* Staff

686 (or INS 686) Public Issues in the Health System *(II, 3)* A systematic review of the development and present status of selected policy issues in the social and economic status of the health and medical care system. *(Lec. 3)* Staff

691, 692 Directed Study in Management Science *(I and II, 1–3 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. 1–3) Pre: permission of instructor.* Staff

693, 694 Internship in Management Science *(I and II, 3 each)* Participation in management and/or problem solving under the supervision and guidance of a sponsoring agency with evaluation by the College of Business Administration. *Pre: proposal acceptance by College of Business Administration, no previous internship credit, and graduate standing. S/U credit.* Staff

695 Seminar in Management Science *(I or II, 3)* Preparation and presentation of papers on selected topics in management science. *Pre: 620 and permission of instructor.* Staff

MKT Courses
Marketing

405 Marketing Communications *(I, 3)*
406 Product Management *(I, 3)*
407 Channels of Distribution *(II, 3)*
408 Pricing Decisions *(II, 3)*
409 Marketing Policy and Problems *(II, 3)*
415 Marketing Research *(II, 3)*
416 Marketing Research Applications *(II, 3)*
434 Advertising Strategy and Management *(II, 3)*
442 Sales Management *(II, 3)*
445 Direct Marketing *(I and II, 3)*
446 Industrial Marketing *(I, 3)*
451 International Marketing *(II, 3)*
491, 492 Directed Study *(I and II, 1–3 each)*

501 Marketing Theory and Practice *(I and II, 2)* Analytical approach to contemporary theory and practice of marketing management. *(Lec. 2) Not open to MBA students.* Staff

601 Managerial Marketing *(I, 4)* Analysis of marketing problems and determination of marketing policies in product development, promotion, pricing, channel selection; legal aspects. *(Lec. 4) Pre: ECN 590, MGS 520, 530, or equivalent or permission of instructor.* Staff

611 Buyer Behavior *(I or II, 3)* Analysis of major factors influencing the behavior and demand of consumers. Emphasis on using these factors to identify and segment target markets and to assess the effects of these factors on markets. *(Lec. 3) Pre: 601 or permission of instructor.* Staff

615 Marketing Research *(I or II, 3)* Marketing information needs and appropriate means of providing the requisite information are analyzed. Several major marketing decision areas and their research implications are examined in depth. *(Lec. 3) Pre: 601, MGS 520 and 530, ECN 590, or permission of instructor.* Staff

631 Advertising Management *(I or II, 3)* A course oriented toward managers responsible for planning, appraising, and administering advertising and promotion activities. *(Lec. 3) Pre: 601 or permission of instructor.* Staff

651 International Marketing Management *(I and II, 3)* Marketing policy making for the multinational firm; organizing for international marketing; its opportunities, pricing, channels, promotion, and research. *(Lec. 3) Pre: 601 or permission of instructor.* Staff

661 Product Management *(I or II, 3)* Development of product policies and strategies. Emphasis on organizing the marketing function to deal with various product-related activities including new product development, life cycle strategies, and product deletion. *(Lec. 3) Pre: 601 or permission of instructor.* Staff

691, 692 Directed Study in Marketing *(I and II, 1–3 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. 1–3) Pre: permission of instructor.* Staff

693, 694 Internship in Marketing *(I and II, 3 each)* Participation in management and/or problem solving under the supervision and guidance of a sponsoring agency with evaluation by the College of Business Administration. *Pre: proposal acceptance by College of Business Administration, no previous internship credit, and graduate standing. S/U credit.* Staff

695, 696 Seminar in Marketing *(I and II, 3 each)* Preparation and presentation of papers on selected topics in marketing. *(Lec. 3) Pre: 601 or permission of instructor.* Staff

Chemical Engineering
M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Stanley M. Barnett, Ph.D., 1963, University of Pennsylvania
Professor Joseph Estrin, Ph.D., 1960, Columbia University
Professor Harold N. Knickle, Ph.D., 1969, Rensselaer Polytechnic Institute
Professor Thomas J. Rockett, Ph.D., 1963, Ohio State University
Professor Vincent C. Rose, Ph.D., 1964, University of Missouri
Associate Professor Arijit Bose, Ph.D., 1981, University of Rochester
Associate Professor Richard Brown, Ph.D., 1977, University of Cambridge
Associate Professor Donald J. Gray, Ph.D., 1980, The University of Rhode Island
Associate Professor Otto Gregory, Ph.D., 1983, Brown University
Adjunct Associate Professor Kenneth Burbank, Ph.D., 1979, Brown University
Adjunct Associate Professor Everett Crisman, Ph.D., 1983, Brown University
Adjunct Associate Professor A. Francis DiMeglio, B.S., 1952, Providence College

Specializations

Biochemical engineering: reactors, purification methods, degradation, and chemical production.

Environmental engineering: separation methods, heavy metal removal, hazardous waste minimization, and desalination.

Food engineering: membrane processes.

Materials engineering: corrosion and erosion, electronic materials processing, ceramic processing polymer films, conducting polymers and phase equilibria.

Transport phenomena: crystal growth, nucleation from solution, interfacial and colloidal phenomena, filtration, flow through porous media, multiphase fluid mechanics, and diffusion through polymers.

Energy engineering: analysis of energy systems, multiphase flow and coal liquefaction.

Unit operations: crystallization, mixing, chromatography, electrodialysis, ultrafiltration and microfiltration.

Master of Science

Admission requirements: GRE; bachelor's degree in chemical engineering; candidates from other engineering fields or from mathematics, biology, chemistry, or physics may be accepted into the program with possible addition of prerequisite courses.

Program requirements: thesis option—CHE 501, 502. Nonthesis option for part-time students, with permission of the department; master's examination and comprehensive report with oral examination.

Doctor of Philosophy

Admission requirements: GRE and M.S. degree in engineering (may be waived for University of Rhode Island graduate students who pass qualifying examination with superior performance).

Program requirements: candidate's program will be determined in consultation with his or her committee and will be based on his or her background and career goals. There is no general language requirement, but a student's committee may require a foreign language or research tool which may be necessary for the candidate's program. In addition to an acceptable dissertation, a candidate must submit a manuscript, based on his or her research, suitable for publication in a technical journal. CHE 501, 502 is also required.

CHE Courses
Chemical Engineering

403, 404 (or OCE 403, 404) Introduction to Ocean Engineering Processes I, II *(I and II, 3 each)*

425 Process Dynamics and Control *(II, 3)*

437 Materials Engineering *(I and II, 3)*

438 Failure Analysis and Prevention *(II, 3)*

439 Nondestructive Evaluation of Materials *(II, 3)*

447 (or FSN 447) Food Engineering *(I, 4)*

464 Industrial Reaction Kinetics *(I, 3)*

471 Analysis of Engineering Data *(I, 3)*

501, 502 Graduate Seminar *(I and II, 1 each)* Seminar discussions including the presentation of papers based on research or detailed literature surveys. *(Lec. 1) Required of all resident graduate students with a maximum of 1 credit per year allowed. May be repeated for a maximum of 2 credits. S/U credit.* Rose

513 Advanced Chemical Engineering Thermodynamics *(I, 3)* Applications of the first, second, and third laws of thermodynamics and their relation to chemical engineering processes. Emphasis on properties of fluids, chemical and physical equilibria, and refrigeration. *(Lec. 3) Pre: 313, 314 or equivalent, graduate standing, or permission of chairperson. In alternate years.* Estrin

530 Polymer Chemistry *(I, 3)* Polymer structure, molecular forces, glass and crystalline transitions, solution properties, polymerization kinetics, molecular weight distribution, fractionation, viscoelastic properties, and transport processes. *(Lec. 3) Pre: CHM 228 and CHE 332 or permission of instructor.* Barnett

531 Polymer Engineering *(I or II, 3)* Polymer processing and mechanical properties of plastics, fibers, and elastomers. *(Lec. 3) Pre: 348 or MCE 448 or permission of instructor.* Barnett

532 Ceramic Engineering *(I, 3)* Properties of ceramic materials as related to starting materials and forming, densification, and finishing processes. Emphasis on resulting phases and microstructure. Application of physical and chemical principles to tailor properties to engineering needs. *(Lec. 3) Pre: 437 or equivalent.* Rockett and Gregory

533 Engineering Metallurgy *(II, 3)* Structures and properties of metals and alloys required to meet typical engineering problems; proper selection of tool materials; properties of stainless steels; materials of special importance in nuclear fields, etc. *(Lec. 2, Lab. 3) Pre: 333 or permission of instructor.* Brown

534 Corrosion and Corrosion Control See Ocean Engineering 534.

535 Advanced Course in Corrosion See Ocean Engineering 535.

537 (or OCE 537) Advanced Materials Engineering *(II, 3)* Engineering properties, molecular design, and applications of materials. Synthesis, fabrication, and processing of materials. Effects of environment on materials, materials products, devices, and systems. *(Lec. 3) Pre: 437 and PHY 341.* Gregory

539 Electron and Light Microscopy of Solids *(I, 3)* Theory and physical principles governing the design and use of light and electron optical systems in identification, analysis, and structural characterization of metals, ceramics, polymers, glasses, and composites. Emphasis on polarized light and scanning electron microscopy. *(Lec. 3) Pre: 437 or equivalent. In alternate years.* Rockett and Brown

540 Phase Equilibria *(II, 3)* Interpretation, construction, and thermodynamics of one, two, three to n-component phase diagrams with examples of their use in chemical, ceramic, metallurgical, and mineral engineering. *Pre: CHM 431 or equivalent.* Rockett

541 Transport Phenomena I *(I, 3)* Analysis of transport processes in fluids with emphasis on diffusion of matter. *(Lec. 3) Pre: 347, 348 or equivalent, graduate standing, or permission of chairperson.* Bose

542 Advances in Interfacial Phenomena *(I, 3)* Topics will include capillarity, surface tension; surface thermodynamics, electrical aspects of surface chemistry; contact angles and wettability; emulsions and foams; adsorption from solutions; hydrodynamic stability of interfaces. *(Lec. 3) Pre: 431, 432, or equivalent or permission of instructor.* Bose

548 (or FSN 548) Separations for Biotechnology *(II, 3)* A study of methods of concentration used in the biotechnology industries for production and isolation of products. *Pre: 348 or 447.* Barnett

549 (or FSN 549) Food and Biochemical Engineering *(II, 3)* Processing of biochemicals with emphasis on protein production, unit operations of protein recovery, immobilized enzyme reactors, and hydrocolloid rheology. *(Lec. 2, Lab. 3) Pre: 447 or FSN 431 or permission of instructor. In alternate years.* Barnett and Rand

560 Chemical and Physical Processes of Integrated Circuit Fabrication *(I, 3)* Chemical and physical processes used in the fabrication of integrated circuits and devices. Emphasis on crystal growth, oxidation, CVD, plasma processes, photochemical processes, solid-state diffusion, lithography, and their relation to device performance. *(Lec. 3) Pre: CHM 431, CHE 349, or equivalent.* Gregory

572 X-ray Diffraction and Fluorescence *(I, 3)* Fundamentals, properties, and applications of X-rays for identification and chemical analysis of materials, determination of lattice parameters, phase transformations, textures, residual stresses, grain and particle sizes, film and plate thicknesses. *(Lec. 2, Lab. 3) Pre: PHY 341. In alternate years.* Staff

573 Mechanical Metallurgy *(I or II, 3)* Behavior and response of metals to mechanical plastic forming. Property control by analysis and design of industrial metal processing. Principles of annealing, forging,

rolling, extruding, rod, wire, and tube drawing. Recent advances and developments. *(Lec. 3) Pre: permission of instructor.* Brown and Gregory

574 Biochemical Engineering I *(I, 3)* Introduction to biotechnology. Includes properties of biological materials, dynamics, control, and operation of biological systems and processing of biological materials. *(Lec. 3) Pre: permission of instructor.* Barnett

591, 592 Special Problems *(I and II, 1–6 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

614 Advanced Chemical Engineering Thermodynamics *(II, 3)* Continuation of 513. *(Lec. 3) Pre: 513.* Estrin

641 Transport Phenomena II *(II, 3)* Steady, unsteady, and multidimensional heat conduction; convection. Mass transport at low and high fluxes; diffusion and chemitheory; approximate methods for heat and mass transfer problems. *(Lec. 3) Pre: 541 or permission of instructor.* Bose

643 Fluid Dynamics *(II, 3)* Advanced problem course dealing with isothermal and nonisothermal flow of compressible and incompressible fluids. *(Lec. 3) In alternate years.* Knickle

644 Process Heat Transfer *(II, 3)* Advanced study of heat transfer by conduction in the steady and unsteady state, radiation, and convection. *(Lec. 3) In alternate years.* Knickle

646 Radiation Heat Transfer
See Mechanical Engineering 646.

647 Mass Transfer I *(I, 3)* Advanced course dealing with the application of mass transfer theory in the distillation of binary, multicomponent, and complex mixtures. *(Lec. 3) In alternate years.* Gray and Knickle

648 Mass Transfer II *(II, 3)* Advanced study of vapor-liquid equilibria and mass-transfer theory applied to gas-liquid systems; humidification and gas absorption, simple and multicomponent systems, with and without chemical reaction. *(Lec. 3)* Gray

650 Advanced Topics in Heat Transfer
See Mechanical Engineering 650.

664 Applied Reaction Kinetics *(II, 3)* Application of principles of chemical reaction kinetics to industrial processes. *(Lec. 3) In alternate years.* Staff

691, 692 Special Problems *(I and II, 1-6 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Chemistry
M.S., Ph.D.

Graduate Faculty

Chairperson: Professor James L. Fasching, Ph.D., 1970, Massachusetts Institute of Technology
Professor Paul I. Abell, Ph.D., 1951, University of Wisconsin
Professor Elie Abushanab, Ph.D., 1965,* University of Wisconsin
Professor Christopher W. Brown, Ph.D., 1967, University of Minnesota
Professor Phyllis R. Brown, Ph.D., 1968, Brown University
Professor Clair J. Cheer, Ph.D., 1964, Wayne State University
Professor David L. Freeman, Ph.D., 1972, Harvard University
Professor Louis J. Kirschenbaum, Ph.D., 1968, Brandeis University
Professor Wilfred H. Nelson, Ph.D., 1962, University of Minnesota
Professor Raymond P. Panzica, Ph.D., 1972, University of Utah
Professor William M. Rosen, Ph.D., 1967, University of California, Riverside
Professor Douglas M. Rosie, Ph.D., 1955, Cornell University
Professor Yuzuru Shimizu, Ph.D., 1962, Hokkaido University
Professor Bruno M. Vittimberga, Ph.D., 1957, University of Illinois
Research Professor Daniel D. Traficante, Ph.D., 1962, Massachusetts Institute of Technology
Associate Professor William B. Euler, Ph.D., 1979, Florida State University
Associate Professor R. Ken Forcé, Ph.D., 1974, University of Nebraska
Associate Professor Sze Cheng Yang, Ph.D., 1973, Columbia University
Assistant Professor Karen I. Peterson, Ph.D., 1982, University of Colorado, Boulder
Assistant Professor Cynthia G. Zoski, Ph.D., 1985, Trent University
Assistant Research Professor William C. Johnson II, Ph.D., 1980, The University of Rhode Island
Adjunct Professor Paul J. Berner, Ph.D., 1964, Stevens Institute of Technology
Adjunct Professor James N. Jacob, Ph.D., 1976, Indian Institute of Science, Bangalore, India
Adjunct Professor George J. Kavarnos, Ph.D., 1968, The University of Rhode Island
Emeritus Professor Leon Goodman, Ph.D., 1950, University of California, Los Angeles

Specializations

Analytical chemistry: electrochemistry, vibrational spectroscopy, neutron activation analysis, high-performance liquid chromatography, laser spectroscopy.

Inorganic chemistry: light scattering, two-dimensional conductors, solution kinetics, organometallics, macrocyclic complexes, metal oxidation states.

Organic chemistry: carbohydrates, heterocycles, synthesis, electron transfer, reaction dynamics, geochemistry, structural analysis.

Physical chemistry: catalysis, molecular spectroscopy, theoretical chemistry, surface chemistry, conducting polymers, statistical mechanics.

Master of Science

Admission requirements: GRE, including advanced test. Preference is given to candidates with undergraduate majors in chemistry or chemical engineering with mathematics through calculus.

Program requirements: placement examination to determine specific program requirements, successful completion of master's qualifying examinations; for thesis option (30 credits)—12 credits of graduate core courses in at least three of the four areas of chemistry, CHM 641 or 642, and thesis; for nonthesis option (36 credits): 18 credits of graduate core courses, CHM 641 or 642, CHM 551, 552, and a written comprehensive examination.

Doctor of Philosophy

Admission requirements: same as for master's degree.

Program requirements: successful completion of qualifying examination; 18 credits of graduate core courses, CHM 641–643 (3 credits).

CHM Courses
Chemistry

401 Intermediate Inorganic Chemistry *(I, 3)*
402 Physical Inorganic Laboratory *(II, 2)*
412 Instrumental Methods of Analysis *(II, 2)*
414 Instrumental Methods of Analysis Laboratory *(II, 2)*
425 Qualitative Organic Analysis *(I, 2)*
427 Intermediate Organic Chemistry *(I, 3)*
431, 432 Physical Chemistry I, II *(I and II, 3 each)*

501 Advanced Inorganic Chemistry I *(I or II, 3)* Systematic analysis of bonding schemes and structural aspects of molecular systems encountered in inorganic chemistry. Special emphasis on electron density distributions, physical methods of analysis, and practical applications of quantum mechanics. *(Lec. 3) Pre: 401.* Euler

502 Advanced Inorganic Chemistry II *(II, 3)* Modern inorganic chemistry approached from experimental, theoretical,

and descriptive points of view. Includes electronic structure and bonding in coordination chemistry, topology, thermodynamics of complex formation, mechanisms, lanthanides, and actinides. *(Lec. 3) Pre: 401 or equivalent.* Kirschenbaum

504 Physical Methods of Inorganic Chemistry *(II, 3)* Theory and application of numerous experimental techniques used for the elucidation of molecular and electronic structure of inorganic molecules. Primary emphasis is on nuclear magnetic resonance, optical, infrared, Raman, and electron paramagnetic resonance spectroscopies. *(Lec. 3) Pre: 401 or permission of instructor.* Euler

511 Advanced Analytical Chemistry I *(I, 3)* Principles of aqueous and nonaqueous titration. Theory of separations including distillation, solvent extraction, and especially gas and liquid chromatography. Statistical treatment of experimental data. *(Lec. 3) Pre: 412 or permission of instructor.* Zoski

512 Advanced Analytical Chemistry II *(II, 3)* Continuation of 412 with emphasis on principles and recent developments in application of physiochemical phenomena to solution of chemical problems. *(Lec. 3) Pre: 412, PHY 340, and MTH 243.* P. Brown

518 Radiochemistry *(II, 3)* Theory and principles of nuclear science as applied to the various fields of chemistry. Radioactivity, radiation detection and measurement, preparation and separation of radionuclides, emphasis on solution of chemical and environmental research problems with the techniques of nuclear chemistry. *(Lec. 3) Pre: 432, PHY 214 or permission of instructor.* Fasching

521 Advanced Organic Chemistry I *(I, 3)* Emphasis on fundamental organic structure theory and reaction mechanisms. *(Lec. 3) Pre: 226 and 228 or equivalent.* Vittimberga

522 Advanced Organic Chemistry II *(II, 3)* Modern synthetic reactions and their application to such areas as natural products. *(Lec. 3) Pre: 521 or permission of instructor.* Cheer

531 Advanced Physical Chemistry I *(I, 3)* Principles and applications of classical physical chemistry. Includes the three laws of thermodynamics, thermochemistry, phase equilibria, kinetic rate laws, and mechanisms of gas phase reactions. *(Lec. 3) Pre: 432 or permission of instructor.* Freeman

532 Advanced Physical Chemistry II *(II, 3)* Introduction to modern chemistry with emphasis on quantum chemistry and statistical thermodynamics. Includes development of quantum theory, applications of quantum theory, development and application of statistical distribution functions. *(Lec. 3) Pre: 432 or permission of instructor.* Freeman

536 Molecular Spectroscopy and Structure *(II, 3)* Theory of molecular dynamics, interaction of electromagnetic radiation with matter. Absorption and emission spectra in infrared, far-infrared, and microwave regions. Raman scattering in the visible region. Use of spectral results in determining physical properties and elucidating molecular structures will be emphasized. *(Lec. 3) Pre: 532 or permission of instructor.* C. Brown

551, 552 Nonthesis Master's Research *(I and II, 3 each)* Research on original problem for fulfillment of research requirement of nonthesis master's degree. Literature survey, laboratory work, and detailed report required. *(Lab. 9) Pre: permission of chairperson.*

566 Foundations for Advanced Chemical Research *(I and II, 2–6)* Directed studies in the foundations and procedures necessary for conducting advanced chemical research. Topics will include library, laboratory, and computer skills. *Pre: 12 credits of chemistry at the graduate level. May be repeated for a maximum of 6 credits.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. A minimum of 6 credits is required of students who have chosen the thesis option for the master's degree. *S/U credit.*

602 The Transition Metals *(I, 3)* Ligand field theory and its applications. Basic quantum mechanical calculations involving thermodynamical, spectral, and magnetic properties of transition metal compounds. *(Lec. 3) Pre: 502.* Nelson

608 Inorganic Reaction Mechanisms *(I or II, 3)* Kinetics and mechanisms of reactions in aqueous solution: techniques, results, and theoretical interpretation. Instrumentation for studying rapid reactions in solution, relaxation methods, electron transfer rates, hydrolytic and solvolytic reactions, metal ion complexation, reactions of biochemical significance. *(Lec. 3) Pre: 502 or permission of instructor. Next offered fall 1990.* Kirschenbaum

615 Trace Analysis of Inorganic Substances *(I, 3)* Principles of trace analysis. Emphasis on techniques and instrumentation. The advantages and limitations of such techniques as atomic absorption spectroscopy, neutron-activation analysis, and flame emission X-ray fluorescence will be presented. *(Lec. 3) Pre: 511 or permission of instructor.* Fasching

616 Applied Analytical Techniques *(II, 3)* Application of analytical instrumentation and techniques to practical problems. Limitations and specific difficulties of analyzing complex matrices in practical research. Problem-oriented presentation. *(Lec. 3) Pre: 511 and 512 or permission of instructor.* P.R. Brown

617 Advanced Instrumentation *(II, 3)* Basic design and theory of instrument design. Discussion of advantages and limitations of specific instruments. Current research in instrument design and critical evaluation of designs. *(Lec. 3) Pre: 511 and ELE 220 or 537 or its equivalent.* Forcé

618 Theory of Separations *(II, 3)* Companion to 615. In-depth presentation of theory of separation processes. Emphasis on methods development, advanced topics, and current advances using gas and liquid chromatography. *(Lec. 3) Pre: 511 or permission of instructor.* P.R. Brown

626 Free Radicals and Photochemistry *(II, 3)* Theory of formation and detection of free radicals and photoexcited states. Bond homolysis, additions, oxidation, polymerization, rearrangements, and other free radical reactions. *(Lec. 3) Pre: 521, 522 or equivalent.* Abell and Vittimberga

636 Advanced Topics in Physical Chemistry *(II, 3)* Advanced topics in quantum chemistry and statistical thermodynamics. Time-dependent and independent perturbation theory, interaction of light with matter, electronic structure of atoms and molecules, Hartree-Fock theory, classical and quantum statistical mechanics. *(Lec. 3) Pre: 531, 532, or permission of instructor.* Freeman

641, 642, 643, 644 Graduate Seminar *(I and II, 1 each)* Results of detailed literature surveys are presented orally and in writing. Required for candidates for advanced degrees in chemistry. *(Lec. 1) S/U credit.* Staff

691 Special Topics *(I and II, 1–3)* Covers the following special research interests: a) carbohydrate chemistry, b) chemical kinetics, c) clinical chemistry, d) computer techniques in analytical chemistry, e) forensic chemistry, f) free-radical rearrangements, g) recent advances in analytical chemistry, h) light scattering, i) molecular orbital theory, j) pericyclic reactions, k) surface chemistry, l) X-ray analysis of organic molecules. *(Lec. 2) Pre: permission of instructor. May be repeated for a maximum of 6 credits.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

930 (or EDC 930) Workshop in Chemistry Topics for Teachers *(I and II, 0–3)* Especially designed for teachers of physical sciences. Basic topics of chemistry from an advanced or pedagogical perspective. *Pre: teacher certification.* Forcé, Peterson, Yang, Euler, and Long

Civil and Environmental Engineering
M.S., Ph.D.

Graduate Faculty

Chairperson: Professor William D. Kovacs, Ph.D., 1968, University of California, Berkeley; P.E.
Professor Everett E. McEwen, D. Eng., 1964, Rensselaer Polytechnic Institute
Professor Calvin P. Poon, Ph.D., 1964, University of Illinois; P.E.
Professor Armand J. Silva, Ph.D., 1965, University of Connecticut; P.E.
Associate Professor Kang W. Lee, Ph.D., 1982, University of Texas, Austin; P.E.
Associate Professor Alan S. Marcus, Ph.D., 1969, University of Massachusetts
Associate Professor Leon T. Thiem, Ph.D., 1982, University of Missouri; P.E.
Associate Professor Daniel Urish, Ph.D., 1978, The University of Rhode Island; P.E.
Associate Professor Raymond M. Wright, Ph.D., 1981, Pennsylvania State University; P.E.
Assistant Professor Dimitrios Karamanlidis, D. Eng., 1979, Technical University of Berlin
Assistant Professor George Tsiatas, Ph.D., 1984, Case Western Reserve University
Assistant Professor George E. Veyera, Ph.D., 1985, Colorado State University
Adjunct Professor Thomas E. Wright, M.S.E., 1975, West Virginia University; P.E.
Adjunct Associate Professor Michael C. Apostal, Ph.D., 1974, State University of New York, Buffalo
Adjunct Associate Professor Robert B. Shaw, M.S., 1966, Purdue University; P.E.
Adjunct Assistant Professor Diane L. Badorek, Ph.D., 1982, University of Missouri; P.E.

Specializations

Environmental engineering: water supply and treatment facilities, municipal and industrial waste treatment, flocculation and coagulation of wastes, pollution of marine sediments, solid waste management, modeling of environmental systems, groundwater pollution, groundwater exploration, coastal groundwater, nonpoint source pollution, stormwater management.

Geotechnical engineering: properties of marine sediments, anchor systems, sediment sampling, dredge material disposal, deep-sea sedimentary processes, sediment transport, constitutive modeling of geological materials, application of nonlinear finite element procedures to mechanics problems, dynamic soil properties and response of soils, *in situ* testing, foundation engineering, geotextiles, earthquake engineering.

Structural engineering: matrix and finite element analysis, computer and numerical methods, marine structures, structural stability, thin-walled structures, coastal structures, deterministic and stochastic structural dynamics, structural reliability, vibration control, earthquakes, soil-structure interaction.

Transportation engineering: properties of pavement materials, pavement theory and design, pavement management system, highway location, and geometric design. For master's level only: traffic operation and control, transportation cost, transportation supply and demand analysis, and transportation system analysis.

Master of Science

Admission requirements: GRE and bachelor's degree in civil or environmental engineering. Candidates in other engineering fields or in mathematics, biology, chemistry, or physics may be accepted with the possible addition of prerequisite courses.

Program requirements: thesis or nonthesis option. 30 credits plus CVE 601, 602; a minimum of two courses taken outside the department. Nonthesis option requires comprehensive report and comprehensive examination.

Doctor of Philosophy

Admission requirements: GRE and master's degree in civil or environmental engineering or in a related field.

Program requirements: 24 credits including the two-course minor outside the candidate's area of specialization, where required, comprehensive examination, and dissertation. Although there is no formal departmental language requirement, the candidate's committee may require proficiency with a research tool or in a foreign language. The candidate's committee may also require a two-course minor outside the candidate's area of specialization.

CVE Courses
Civil and Environmental Engineering

442 Traffic Engineering *(I, 3)*
446 Transportation Engineering *(II, 3)*
453 Computer Analysis of Structures *(I, 3)*
472 Industrial Air Pollution *(I or II, 3)*
474 Water Quality Sampling and Analysis *(II, 3)*
475 Water in the Environment *(II, 3)*
478 Hazardous Waste Disposal and Solid Waste Management *(I or II, 3)*
483 Foundation Engineering *(II, 3)*
485 (or GEL 485) Engineering Geophysics *(II, 3)*
491, 492 Special Problems *(I and II, 1–6 each)*
495 Civil and Environmental Engineering Systems *(I, 3)*

523 Coastal Structures
See Ocean Engineering 523.

545 Pavement Design *(I, 3)* Pavement types; pavement system components; stresses in the pavement structure. Design factors and criteria, pavement stabilization, structural design of flexible and rigid pavements for highways and airports, pavement maintenance and overlay design. *(Lec. 3) Pre: 347 or equivalent. Offered fall of odd calendar years. Next offered fall 1989.* Lee and Kovacs

546 Urban and Rural Transportation
See Community Planning 546.

547 Geometric Design of Highways *(I, 3)* Evaluation of alternative designs. Criteria and practices of geometric design; at grade intersections, interchanges, channelization, weaving parking facilities, and road appurtenances; safety considerations, lane balancing, ramps, and terminals. *(Lec. 3) Pre: 347 or equivalent. Offered fall of even calendar years. Next offered fall 1990.* Lee

548 Pavement Materials and Mix Design *(II, 3)* Surficial soils. Material characterization and testing; elastic, viscoelastic, and plastic behavior. Fracture, fatigue, and rutting; design of bituminous mixtures. Other pavement materials and additives. Pavement recycling. *(Lec. 2, Lab. 3) Pre: 347 or equivalent. Offered spring of even calendar years. Next offered spring 1990.* Lee

551 Finite Element Analysis in Civil Engineering I *(I or II, 3)* Direct stiffness method. Rayleigh-Ritz and Galerkin methods. Isoparametric elements. Frames, trusses, plane stress and strain. Bending of thin plates. *(Lec. 3) Pre: 453 or permission of instructor.* Staff

556 Variational Methods in Structural Engineering *(I, 3)* Introduction; principle of minimum potential energy; principle of minimum complementary energy; generalized variational formulations; principles with relaxed continuity requirements; application to structures, and soils. *(Lec. 3) Pre: 453 or permission of instructor. Offered every fourth year. Next offered fall 1990.* Karamanlidis

560 Structural Design *(I or II, 3)* Behavior and design of structural systems, selected topics in steel, reinforced concrete, and prestressed concrete. *(Lec. 3) Pre: 460 and 465. Offered every third year. Next offered spring 1991.* McEwen, Marcus, and Tsiatas

565 Structural Dynamics *(I or II, 3)* Simplified models and their equations of motion; analytical solution methods; Fourier analysis; Duhamel integral; nonlinearities; computer-oriented solution algorithms and their implementation. Applications. *(Lec. 2, Lab. 3) Pre: 453. In alternate years. Next offered fall 1989.* Staff

568 (or MCE 568) Theory of Plates *(I or II, 3)* Development of basic plate equations. Classical solution examples of rectangular and circular plates. Additional topics selected from: orthotropic plates, large deflections, finite element, and numerical solutions. *(Lec. 3) Pre: 220 and MTH 244.* Karamanlidis and Nash

570 Sanitary Chemistry *(I, 3)* Application of analytical chemistry to analysis of natural waters; physical chemistry and organic

chemistry of aqueous media; chemical principles applicable to operations of sanitary engineering. *(Lec. 3) Pre: permission of instructor.* Thiem

571 Sanitary Chemistry Laboratory *(II, 3)* Applications of chemical laboratory procedures to control of water and wastewater treatment processes. *(Lec. 2, Lab. 3) Pre: 570.* Thiem

572 Biosystems in Sanitary Engineering *(I or II, 3)* Microorganisms which constitute the biological systems in water pollution, water purification, and wastewater treatment. Application of principles of microbiology and biochemistry to analysis and design in fields of sanitary engineering and water resources. *(Lec. 3) Pre: permission of instructor.* Poon

573 Theory of Water Purification and Treatment *(I, 3)* Principles of modern water purification and engineering practices. Aeration, deodorization, sterilization, coagulation, filtration, water softening, iron removal, disinfection, and corrosion control. *(Lec. 3)* Thiem

575 Open-Channel Hydraulics *(I or II, 3)* Analysis of uniform, critical, varied flow, and unsteady flow in open channels. Principles will be applied to open-channel design. *(Lec. 3) Pre: MCE 354.* Wright

581 (or OCE 581) Experimental Geomechanics *(I or II, 3)* Advanced methods and techniques of geotechnical testing. Behavior of granular and cohesive soils with determination of engineering properties. Interpretation, evaluation, and engineering applications of test data. Emphasis on shearing strength, consolidation, bearing capacity, earth pressures, seepage, and slope stability. *(Lec. 2, Lab. 3) Pre: 381 or equivalent.* Kovacs, Silva, and Veyera

582 Seabed Geotechnics
See Ocean Engineering 582.

583 (or OCE 583) Advanced Foundation Engineering *(I or II, 3)* Applications of soil mechanics principles to analysis and design of pile foundations, drilled piers, flexible retaining structures, braced excavations, cofferdams, miscellaneous advanced foundation problems. *(Lec. 3) Pre: 381 or equivalent. Offered in fall of even calendar years. Next offered fall 1990.* Kovacs, Silva, and Veyera

585 Soil Dynamics *(I or II, 3)* Vibration characteristics, wave propagation in soils, foundation vibration theory, foundation design for vibrating loads, vibration isolation, blast vibrations, dynamic soil properties, liquefaction potential, vibratory and dynamic compaction, computer implementation. *(Lec. 3) Pre: 483 or equivalent. Offered in odd calendar years. Next offered spring 1991.* Kovacs and Veyera

587 Groundwater Flow and Seepage Pressures *(II, 3)* Hydrodynamics of fluid flow through porous media. Analytical methods for steady and unsteady seepage in aquifers; theoretical analysis with practical modification of seepage problems involving foundations, drainage structures, earth dams, and dewatering. *(Lec. 2, Lab. 3) Pre: 381 and permission of instructor. Offered in spring of odd calendar years.* Urish and Kovacs

588 Groundwater Hydrology *(II, 3)* Quantitative methods of groundwater hydrology including determination of aquifer properties and yield. Modeling of groundwater systems for management quantity of water, movement of contaminants, and well design. Field and laboratory measurements. *(Lec. 2, Lab. 3) Pre: MCE 354 and CVE 381 or equivalent. Offered in spring of even calendar years.* Urish

591 Special Problems *(I, 1–6)* Advanced work under supervision of a staff member arranged to suit individual requirements of the student. *Pre: permission of chairperson. (Lec. or Lab. according to nature of problems)* Staff

592 Special Problems *(II, 1–6)* Advanced work under supervision of a staff member arranged to suit individual requirements of the student. *Pre: permission of chairperson.* Staff

596 Numerical Methods in Structural Engineering *(I or II, 3)* Methods of successive approximations and numerical procedures in the solution of stress, vibration, and stability problems in structural members. Nonuniform members, elastic supports, plates, torsion. *(Lec. 3) Pre: permission of chairperson. Offered fall of even calendar years. Next offered spring 1990.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

601, 602 Graduate Seminar *(I and II, 1 each)* Discussions and presentation of papers based on research or detailed literature surveys. *(Lec. 1) Required of all resident graduate students with a maximum of 1 credit per year allowed. May be repeated for a maximum of 2 credits.* Staff

626 Marine Structural Design
See Ocean Engineering 626.

641 Pavement Evaluation and Rehabilitation *(II, 3)* Pavement performance concepts. Criteria for pavement evaluation. Measurement of pavement distress and structural capacity. Analysis and interpretation of pavement evaluation data. Correlation of data with performance ratings. Formulation and evaluation of maintenance and rehabilitation alternatives. *(Lec. 3) Pre: 545 or equivalent. Offered spring of odd calendar years. Next offered spring 1991.* Lee

655 Finite Element Analysis in Civil Engineering II *(I, 3)* Isoparametric models for three-dimensional continua, hierarchical elements. Reduced integration concepts, penalty method, discrete Kirchhoff method. Eulerian, total, and updated Lagrangian formulations. *(Lec. 3) Pre: 551 or permission of instructor. Offered fall of even calendar years. Next offered fall 1990.* Staff

657 Structural Stability *(II, 3)* Introduction; principal forms of equilibrium paths and their stability; conservative elastic systems; buckling of prismatic members; imperfections; plastic deformations; postbuckling of frames and reticulated structures; numerical methods; catastrophe theory. *(Lec. 3) Pre: 556 or permission of instructor.* Karamanlidis, McEwen, and Tsiatas

665 Advanced Topics in Structural Dynamics *(I or II, 3)* Equations of motion of systems and continuous bodies; analytical and numerical solution methods; large deflections and plasticity; time-stepping algorithms; active control of tall buildings; earthquake resistant structures; applications. *(Lec. 3) Pre: 565. Offered every third year. Next offered spring 1990.* Karamanlidis, McEwen, and Tsiatas

668 Theory of Shells
See Mechanical Engineering 668.

672 Water Pollution Control and Treatment of Wastewater *(I or II, 3)* Wastewater characteristics, effects, and purification in natural water, government control strategies and impacts, cost of control, theory and mathematical concepts of secondary and tertiary treatment process, their limitations, and late developments. *(Lec. 3) Pre: one year of chemistry and biology, MTH 243 and CVE 572 or their equivalents and permission of instructor.* Poon

674 Sanitary Engineering Laboratory *(I or II, 3)* Advanced phases of sewage treatment and purification including sludge digestion, sludge gas analysis, biochemical oxygen demand, conditioning of sludge, activated sludge, sewage-trickling filters, and chemical precipitation. *(Lec. 2, Lab. 3) Pre: permission of instructor.* Thiem

675 Sanitary Engineering Design *(I or II, 3)* Functional design of modern water treatment plant providing treatment of water for domestic and industrial consumption. *(Lec. 1, Lab. 6) Pre: permission of instructor.* Poon

676 Sanitary Engineering Design *(I or II, 3)* Functional design of modern sewage treatment works. *(Lec. 1, Lab. 6) Pre: 672.* Staff

677 Stream and Estuarine Analysis *(I or II, 3)* Fundamentals and mathematical concepts of physical and biological factors applied to the evaluation of the pollution capacity of streams and estuaries. *(Lec. 3) Pre: MTH 244.* Wright

681 Advanced Geotechnical Engineering I *(I or II, 3)* Advanced study of geotechnical principles and theory. Physical and chemical properties of soils; particulate mechan-

ics; effective stress principle; permeability; steady-state and transient seepage; consolidation; stress distribution; miscellaneous topics. *(Lec. 3) Pre: 381 or equivalent and permission of instructor.* Kovancs, Silva, and Veyera

682 Advanced Geotechnical Engineering II *(I or II, 3)* Advanced study of geotechnical engineering principles and theory. Stress-strain behavior; constitutive relationships; failure theories; applications of theories of elasticity, viscoelasticity, and plasticity; shear strength of sands; shear strength of clays; slope stability analysis; miscellaneous topics. *(Lec. 3) Pre: 381 or equivalent and permission of instructor.* Kovacs, Silva, and Veyera

684 Soil Structure Interaction *(I, 3)* Introduction, energy, finite difference, finite element methods, beams and plates on elastic foundation, analysis of single and group piles, wave equation, joints, interface-related topics, computer application, software developments. *(Lec. 3) Pre: 551. Offered every fourth year. Next offered fall 1990.* Karamanlidis

687 Geotechnical Earthquake Engineering *(I, 3)* Seismology and seismicity; surface faulting and ground motion characteristics; response spectra; dynamic soil properties; dynamic response of soil layers, embankments, and slopes; influence of local soil conditions on site response; evaluation of design earthquakes; response analysis. *(Lec. 3) Pre: 483.* Kovacs, Tsiatas, or Veyera

688 Marine Geomechanics
See Ocean Engineering 688.

689 Selected Topics in Geomechanics
See Ocean Engineering 689.

691, 692 Special Problems *(I and II, 1–6 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problems) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

696 Computational Methods for Inelastic Stress Analysis *(II, 3)* Introduction, basic numerical solution for nonlinear problems; elastoplasticity and viscoplasticity in one dimension; elastoplastic analysis of beams and frames; elastoplasticity and viscoplasticity in two dimensions; finite element expressions and program structure. *(Lec. 3) Pre: 551 or permission of instructor. Offered every fourth year. Next offered spring 1991.* Karamanlidis and McEwen

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Clinical Laboratory Science
M.S.

Graduate Faculty

Chairperson: Professor David C. Laux, Ph.D., 1971, University of Arizona
Coordinator: Gregory E. Paquette, M.S., 1981, Southeastern Massachusetts University
Professor Norman A. Campbell, Ph.D., 1972, University of Wisconsin
Professor Pei Wen Chang, Ph.D., 1965, Yale University
Professor Albert H. Taubman, Ph.D., 1971, University of Pittsburgh
Professor George C. Tremblay, Ph.D., 1965, St. Louis University
Professor Norris P. Wood, Ph.D., 1955, University of Pennsylvania
Associate Professor Jay F. Sperry, Ph.D., 1974, University of Kansas
Assistant Professor John Boulmetis, Ph.D., 1982, Ohio State University
Assistant Professor Gloria Williams, M.S., 1979, Southeastern Massachusetts University
Adjunct Professor Michael Sheff, Ph.D., 1957, Sheffield University
Adjunct Professor Kurt Stottmeier, Ph.D., 1962, University of Berlin
Adjunct Associate Professor Jacob A. Canick, Ph.D., The University of Rhode Island
Adjunct Associate Professor Steven Opal, M.D., 1976, Albany Medical College
Adjunct Assistant Professor Julia E. Blazek, Ph.D., 1982, The University of Rhode Island
Adjunct Assistant Professor Judith S. Heelan, Ph.D., 1982, The University of Rhode Island
Adjunct Assistant Professor Margaret Kenney, M.S., 1983, Southeastern Massachusetts University
Adjunct Assistant Professor Marjorie G. Kimball, M.S., 1981, Northeastern University
Adjunct Assistant Professor Anthony J. Lewandowski, M.S., 1985, Southeastern Massachusetts University
Adjunct Assistant Professor Kenneth Mayer, M.D., 1977, Northeastern University
Adjunct Assistant Professor Ann Robinson, Ph.D., 1980, University of Chicago
Adjunct Assistant Professor Charles Seymour, Ph.D., 1975, Cornell University
Adjunct Assistant Professor Gloria Williams, M.S., 1979, Southeastern Massachusetts University
Adjunct Assistant Professor Burrows T. Younkin, Ph.D., 1981, Columbia Pacific University

Specializations

Major specializations in clinical chemistry, clinical microbiology, hematology, immunohematology; minor specializations in adult education and management.

Master of Science

Admissions requirements: GRE, bachelor's degree in medical technology, microbiology, chemistry, or a related area; certification by a nationally recognized certifying agency, as a generalist or a specialist in clinical laboratory science, or a minimum of one year's postbaccalaureate clinical laboratory experience.

Program requirements: 36 credits including BCP 551, EDC 582, EST 407 or 409, MIC 510, 512, 513, and 9–12 credits in the area of specialization. (MTC 502, 532, 543 for clinical chemistry; ASP 534, MTC 501, 515, 541 for clinical microbiology; MTC 503, 520, 521, 530 for hematology; MTC 503, 520, 530, 531 for immunohematology). The remainder of courses are selected from other clinical laboratory science specialties, education, or management. Comprehensive written examination. Major research paper. The following courses are recommended for a minor specialization in management: PHP 651, 652, 680. These courses are recommended for a minor specialization in adult education: EDC 505, 529, 583, 584.

MTC Courses
Medical Technology

483 (or MIC 483) Introductory Diagnostic Microbiology *(I, 3)*

501 (or MIC 501) Advanced Clinical Microbiology I *(I or II, 3)* Current methodology employed in the processing of clinical microbiology specimens, isolation and identification of pathogenic microorganisms, and determination of antimicrobial susceptibility. *(Lec. 3) Pre: 401 or MIC 432 or equivalent.* Blazek and Stottmeier

502 Advanced Clinical Chemistry for Medical Technology *(I or II, 3)* The pathophysiologic mechanisms as they correlate to clinical chemistry data. Topics include mechanisms of pathology and analytical techniques. *(Lec. 3) Pre: 402 or equivalent.* Kelly, Driscoll, and Younkin

503 Advanced Hemostasis and Coagulation *(I or II, 3)* Coagulation disorders, their mechanisms and pathogenesis. Advanced analytical techniques will be included. *(Lec.3) Pre: 404 or equivalent.* Baglini

510 Clinical Laboratory Supervision *(I or II, 3)* Supervisory management principles applicable to the clinical laboratory. Includes the processes of supervision, decision making, job performance and evaluation, communications, organizational behavior, and labor relations in the modern laboratory. *(Lec. 3) Pre: 400-level medical technology internship or equivalent.* Staff

512 Special Problems in Clinical Laboratory Science *(I or II, 3–6)* Assigned research on an advanced level. Students required to outline problem, conduct the necessary research or experimental work, and present

observations and conclusions in a written and oral report. *Pre: 400-level medical technology internship or equivalent.* Staff

513 (or MIC 513) Advanced Clinical Immunology *(I or II, 3)* Theory, application, and techniques used in clinical immunology: immunochemistry, serology, immunohematology, immunopathology. *(Lec. 3) Pre: 406 or MIC 533 or equivalent.* Meglio

515 (or MIC 515) Infectious Diseases *(I or II, 3)* Survey of infectious diseases with emphasis on clinician's role as it relates to the clinical microbiology laboratory. Topics include pathogenesis, diagnosis, antimicrobial agents, public health microbiology, epidemiology, infection control. *(Lec. 3) Pre: 401 or 501 or equivalent.* Staff

520 Advanced Hematology I *(I or II, 3)* Special problems, advanced techniques, and methodology in hematology; laboratory approach emphasized. *(Lec. 3) Pre: 404 or equivalent.* Barker

521 Advanced Hematology II *(I or II, 3)* Hematologic disorders: mechanisms, pathogenesis, diagnosis, and treatment; clinical approach emphasized. *(Lec. 3) Pre: 404 or equivalent.* Barker

530 Advanced Immunohematology I *(I or II, 3)* Blood grouping and blood banking with emphasis on recent advances. Techniques used for identification of immune disorders, component preparation, tests to determine compatibility. *(Lec. 3) Pre: 403 or equivalent.* Kenney and Lewandowski

531 Advanced Immunohematology II *(I or II, 3)* Special problems, advanced techniques, and methodology in clinical immunohematology and blood banking. *(Lec. 3) Pre: 403 or equivalent.* Kenney and Lewandowski

532 Clinical Endocrinology *(I or II, 3)* Current theory, application, and techniques used in diagnostic endocrinology. *(Lec. 3) Pre: 402 or equivalent.* Canick

541 (or MIC 541) Advanced Clinical Microbiology II *(I or II, 3)* Current research and clinical methodology in clinical mycology, parasitology, mycobacteriology, epidemiology, and infectious disease serology. *(Lec. 3) Pre: 401 or MIC 432, or equivalent.* Blazek and Stottmeier

543 Advanced Clinical Chemistry *(I, II, or SS, 3)* A comprehensive study of pathophysiologic mechanisms as they relate to clinical chemistry. Topics include immunochemistry, automation enzymology, pharmacology, and endocrinology. *(Lec. 3) Pre: 402 or equivalent.* Canick and Kelley

590 Special Problems in Clinical Chemistry *(I, II, or SS, 1–6)* Intensive tutorial work, research, and readings in clinical chemistry. *Pre: graduate standing and permission of chairperson.* Staff

591 Special Problems in Clinical Microbiology *(I, II, or SS, 1–6)* Intensive tutorial work, research, and readings in clinical microbiology. *Pre: graduate standing and permission of chairperson.* Staff

592 Special Problems in Hematology *(I, II, or SS, 1–6)* Intensive tutorial work, research, and readings in hematology. *Pre: graduate standing or permission of chairperson.* Staff

593 Special Problems in Immunohematology *(I, II, or SS, 1–6)* Intensive tutorial work, research, and readings in immunohematology. *Pre: graduate standing and permission of chairperson.* Staff

Community Planning and Area Development

M.C.P.

Graduate Faculty

Chairperson: Associate Professor Howard H. Foster, Jr., Ph.D., 1970, Cornell University
Professor Marcia Marker Feld, Ph.D., 1973, Harvard University
Associate Professor John J. Kupa, Ph.D., 1966, University of Minnesota
Assistant Professor Farhad Atash, Ph.D., 1986, Rutgers—The State University
Assistant Professor Marshall M.A. Feldman, Ph.D., 1981, University of California
Adjunct Professor Carol J. Thomas, M.S., 1948, University of Connecticut
Adjunct Associate Professor Glenn R. Kumekawa, M.A., 1956, Brown University
Adjunct Professor Robert B. Shaw, M.S.C.E., 1966, Purdue University
Adjunct Associate Professor Albert R. Veri, M.L.A., 1969, Harvard University
Adjunct Assistant Professor Douglas Johnson, Ph.D., 1979, Massachusetts Institute of Technology
Adjunct Assistant Professor Patt Manheim, Ph.D., 1984, Cornell University
Adjunct Assistant Professor Daniel J. Schatz, J.D., 1978, University of Maine
Adjunct Assistant Professor David S. Winsor, M.C.P., 1980, The University of Rhode Island

Specializations

The curriculum educates and trains planners for professional positions in community planning and development agencies in either the public or the private sector. A core of study in substantive theory and methods relating to urban or urbanizing communities is required. In addition, three specializations are offered: community revitalization planning, public policy and planning, and environmental planning and design.

The community revitalization planning specialization builds an urban economic development planning orientation with emphasis on urban revitalization, urban renewal, housing, economic development, and planning. The public policy and planning specialization differs from the community revitalization specialization in terms of its focus on social planning and social welfare in the urban metropolitan context. The major emphasis is on planning as a public policy process with emphasis on social services, special populations, and community development. The environmental planning and design specialization emphasizes the relationship between the built, or human, environment and the natural environment. Concerns for the environmental impacts of development are addressed, combining physical planning with natural resource conservation planning.

There is also the opportunity for students to choose electives in areas of special interest in community planning or related departments.

Master of Community Planning

Admission requirements: GRE, undergraduate background in the social sciences, architecture, landscape architecture, natural resources, engineering, or geography preferred. An undergraduate course in social statistics is required for the degree. Undergraduate courses in computer science and microeconomics are recommended. The degree is accredited by the Planning Accreditation Board and is offered through the New England Regional Program.

Program requirements: CPL 501, 510, 511, 512, 522, 523, 525, 526, 630; 12 credits in the selected specialization; 6 credits of thesis, or research project, and a comprehensive examination; summer internship or equivalent experience. The two-year program of 54 credits is distributed one-half in core courses and about one-half in the elected specialization, free electives, and thesis or project research. Students normally take 12–15 credits per semester to complete studies in two years.

CPL Courses
Community Planning

410 Fundamentals of Urban Planning *(I and II, 3)*

434 Introduction to Environmental Law *(II, 3)*

501 Introduction to Community Planning History and Theory *(I, 3)* The development of community planning in the U.S., history of governmental planning and evolution of the planning profession, theoretical elements and constructs basic to contemporary planning practice. *(Lec. 3)* Foster

510 Community Planning and Political and Social Change *(II, 3)* Introduction to community political systems and central theories of the determinants for social and planned change in urban and urbanizing communities. Focus on methodologies of political and social assessments. *(Sem. 3)* Feld

511 Planning and Natural Environmental Systems *(I, 3)* Introduction to theories, methodologies, and substantive concerns of environmental resource analysis with

attention given to coastal environmental issues. Focus on land, soils, watersheds, water quality, vegetation, air quality, wildlife, noise pollution. *(Lec. 3)* Kupa

512 Spatial and Fiscal Relationships of Communities *(I, 3)* Introduction to theories and methods of spatial settlement, determinants of residential, commercial, and industrial markets, and location and dimensions of public finance and fiscal analysis. Focus on metropolitan and nonmetropolitan communities. *(Sem. 3)* Staff

516 Seminar on the Urban Waterfront See Marine Affairs 516.

522 Planning Law *(I, 3)* General review and discussion of legal principles and thought concerned with property rights, political power, and the legal aspects pertinent to the planning and development of public and private activities. *(Lec. 3) Pre: second-year graduate standing or permission of instructor.* Schatz

523 Planning Theory *(I, 3)* Critical survey of planning theories and contemporary planning concepts. Values, assumptions, and processes of various planning paradigms as related to decisions in community planning. Specific emphasis on contingent planning theory. *(Sem. 3)* Feld

525 Introduction to Planning Methods *(I, 3)* Introduction to basic methods in comprehensive and functional area planning. Emphasis on development of manual skills in basic demographic, economic, and land-use projections; project planning management and evaluative techniques. *(Sem. 3) Pre: EST 408 or permission of instructor.* Winsor

526 Planning and Policy Analysis *(II, 3)* Advanced seminar in computer-aided techniques applied to 525 methods. Use of SPSS/ SAS packages. Additional methods include survey research methodology, data collection and formatting, and application of statistical techniques. *(Sem. 3) Pre: 525.* Winsor

530 Urban Design and Public Policy *(I, 3)* Significant concepts of historical and contemporary urban form ranging from entire city to architectural details. Public policy initiatives; historic preservation, architectural review boards, signage control. *(Lec. 3) In alternate years.* Atash

535 Human Resources Planning *(I, 3)* Human resources planning in community planning and development. Emphasis on social implications of urban development with attention to processes and delivery system planning for education, health, and social services. *(Sem. 3) Pre: 510 or permission of instructor. In alternate years.* Feld

536 International Comparisons in Community Planning *(II, 3)* Community and regional development issues and policies in advanced and developing countries. Emphasis on the generation and spatial patterns of economic development and related public policies and capital investment strategies. *(Sem. 3) In alternate years.* Atash

537 (or REN 532) Land Resources Economics *(I, 3)* The study of economic relationships of man and scarce natural and man-made resources. Supply and demand, rent theory, resources conservation, and the impact of public policy and law. *(Lec. 3)* Wichelns

538 Site Planning *(I, 3)* Site analysis and planning, including street design, principles of house grouping, and residential subdivision layout. *(Lec. 2, Lab. 3) Pre: 520 or permission of instructor. In alternate years.* Atash

539 Environmental Law *(II, 3)* Alternate policy approaches involving economic, ecological, and political sciences. Technological, planning, and legal issues in protection, control, and development of the environment. Particular focus on coastal communities. *(Lec. 3)* Schatz

541 Urban and Rural Housing Policy *(I, 3)* Assessment of urban and rural housing needs; relationship of housing to national economic policy; housing finance; production and cost characteristics; tax policy, filtering and neighborhood change; and housing policy assessments. *(Sem. 3) Pre: 410 or 501 or permission of instructor. In alternate years.* Staff

543 Social Indicator Analysis in Planning *(I, 3)* The use of social and economic indicators in planning and policy analysis. Quantitative description and analyses of social conditions and trends designed to provide information to governmental and institutional policy makers. *(Sem. 3) Pre: 510 or permission of instructor. In alternate years.* Feld

545 Land Development Seminar *(II, 3)* A study of land management techniques including zoning, subdivision regulation, and land suitability and analysis; their use, and environmental implications in land and water development. *(Sem. 3) Pre: 511 or permission of instructor.* Kupa

546 (or CVE 546) Urban and Rural Transportation *(I, 3)* Issues confronting planning for urban and rural transportation systems; the variety of policies governments pursue in addressing issues and problems; technical and political constraints, transportation studies, and demand analysis techniques. *(Lec. 3) Pre: 410 or 501 or permission of instructor. In alternate years.* Shaw and Lee

549 Seminar in Ecological Planning *(II, 3)* Advanced seminar in ecological planning. Emphasis on hazardous waste, power plant siting, major transportation facilities, solid waste, aquifer protection, among others. Particular emphasis on wetlands and marine and coastal settings. *(Sem. 3) Pre: 511 or permission of instructor.* Kupa

589 Master's Project Research *(I and/or II, 1–6)* A substantial, self-directed planning project, by one or several students, under general guidance of a major professor. Number of credits to be determined each semester. *S/U credit.* Staff

591, 592 Special Problems in Planning *(I or II, 1–6 each)* Individual investigation of special problems in planning. Staff

593, 594, 595, 596, 597, 598 Special Problems in Planning *(I or II, 1–6 each)* Group investigation of special problems in planning. Staff

599 Master's Thesis Research *(I or II, 1–6)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

612 Growth Management Strategies *(II, 3)* Advanced seminar in plan implementation in small communities. Emphasis on enabling legislation for nonmetropolitan small towns including coastal communities, capital budgeting, fiscal impact, special districts, and area-wide relationships. *(Sem. 3) Pre: 610 and 611 or permission of instructor.* Foster

624 Planning Policy and Management in Urban Areas *(II, 3)* City planning as applied to urban policy in cities and metropolitan areas. Includes social, economic, and physical planning in the context of community development programs and management processes. *(Sem. 3) Pre: 501, 511, 525, or permission of instructor.* Feld

625 Central City Revitalization and Implementation *(I, 3)* Advanced concentration course in central city planning. Focus on the problems of central cities and the causes of these problems. Emphasis on government policies to deal with the problems of the inner city. *(Sem. 3) Pre: 624 or permission of instructor.* Staff

630 Comprehensive Planning Studio *(II, 6)* Applied team problem solving. Planning experience working with specific client or community emphasizing sequential process and group product. Project to include problem definition, conceptual design analysis, and oral/graphic presentations. *(Studio 6) Pre: 501, 511, 523, 525, or permission of instructor.* Atash and Foster

631 Advanced Planning Studio *(I, 6)* Team projects in planning and design; research and program development; field studies and problem analysis in local and state contexts. Development and evaluation of alternative solutions. *(Studio/Sem.) Pre: 630 or permission of instructor.* Staff

691, 692 Special Problems in Planning *(I or II, 1–6 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. Staff

693, 694 Special Problems *(I or II, 1–6 each)* Advanced work under the supervision of a staff member arranged to suit the requirements of a group of students. Staff

Comparative Literature Studies
M.A.

Graduate Faculty

Coordinator: (French) Associate Professor Ira A. Kuhn, Ph.D., 1970, University of Kansas

Department of English
Professor Clare M. Murphy, Ph.D., 1964, University of Pittsburgh
Professor Daniel D. Pearlman, Ph.D., 1968, Columbia University
Associate Professor Diedre Badejo, Ph.D., 1985, University of California, Los Angeles
Associate Professor Wilfred P. Dvorak, Ph.D., 1972, Indiana University
Associate Professor Dorothy Jacobs, Ph.D., 1968, University of Michigan
Associate Professor John R. Leo, Ph.D., 1972, Northwestern University
Associate Professor Ralph M. Tutt, Ph.D., 1966, Duke University
Professor Emeritus Jordan Y. Miller, Ph.D., 1957, Columbia University
Professor Emerita Edna L. Steeves, Ph.D., 1948, Columbia University

Department of Languages
(French) Professor Harold A. Waters, Ph.D., 1956, University of Washington
(French–Linguistics) Professor Kenneth H. Rogers, Ph.D., 1970, Columbia University
(German) Professor Otto Dornberg, Ph.D., 1966, Ohio State University
(Portuguese) Professor Gregory R. McNab, Jr., Ph.D., 1973, New York University
(Italian) Professor Paschal Viglionese, Ph.D., 1969, Rutgers—The State University
(Russian) Professor Sona Aronian, Ph.D., 1971, Yale University
(Spanish) Professor Robert Manteiga, Ph.D., 1977, University of Virginia
(Spanish) Associate Professor Thomas D. Morin, Ph.D., 1975, Columbia University

Specializations

English language literatures (American, British, Irish, Scots), Classical, French (including Quebecois and Black French literature), German, Italian, Portuguese, Russian, and Hispanic literatures.

Master of Arts

Admission requirements: GRE; B.A. degree; formal training or demonstrable competence in literature; high level of proficiency in one foreign language.

Program requirements: first literature, 9 credits; second literature, 6 credits (one of the literatures may be English); CLS 510; electives pertinent to a student's program of study to be approved by the major professor and advisory committee; reading knowledge of a second foreign language; comprehensive examination; thesis option, 24 credits; nonthesis option, 30 credits, including 6 credits of independent study resulting in the production of extended essays.

CLS Courses
Comparative Literature Studies

450 Studies in Comparative Literature *(I or II, 3)*

510 Introduction to Comparative Literature *(I or II, 3)* Theoretical and practical concerns of comparative literature: its nature and scope, methods, bibliography, and special problems. *(Lec. 3) Pre: graduate standing or permission of chairperson.* Viglionese

520 Literary Theory and Criticism *(I or II, 3)* Metacriticism: literary criticism as theory and practice and the relationship between literary and critical discourse. *(Lec. 3) Pre: graduate standing or permission of chairperson. May be repeated once with change of topic.* Staff

530 Approaches in Comparative Literature *(I or II, 3)* Study of theme/myth, movement/era, genre/forms in two or more literatures, or interrelations with other disciplines. *(Lec. 3) Pre: graduate standing or permission of chairperson. May be repeated once with a change of topic.* Staff

597 Special Problems *(I and II, 1–6)* Group and/or individual investigation of special problems in comparative literature studies. Staff

599 Master's Thesis Research *(I and II, 1–6)* Number of credits is determined each semester in consultation with the major professor and the Comparative Literature Studies Advisory Committee. Staff

See other listings under English and Languages.

Computer Science
M.S.

Graduate Faculty

Chairperson: Associate Professor Edmund A. Lamagna, Ph.D., 1975, Brown University
Professor Edward J. Carney, Ph.D., 1967, Iowa State University Associate
Professor Gerard M. Baudet, Ph.D., 1978, Carnegie Mellon University
Associate Professor Frank M. Carrano, Ph.D., 1969, Syracuse University
Associate Professor James G. Kowalski, Ph.D., 1975, University of Notre Dame
Assistant Professor Eugene E. Kohlbecker, Ph.D., 1986, Indiana University
Assistant Professor Bala Ravikumar, Ph.D., 1987, University of Minnesota
Adjunct Associate Professor Charles A. Arnold, Ph.D., 1976, Harvard University
Adjunct Assistant Professor Robert V. Rubin, Ph.D., 1988, Brown University
Professor Emeritus William J. Hemmerle, Ph.D., 1963, Iowa State University

Specializations

Analysis of algorithms, artificial intelligence, computer architecture, programming languages, theory of computation, databases, operating systems, distributed computing, expert systems, graphical user interfaces, software engineering, symbolic and algebraic computation, VLSI systems, numerical analysis, statistical computation, simulation, computer-aided education.

Master of Science

Admission requirements: bachelor's degree, including undergraduate training in computer science at least through the syntax and semantics of a variety of programming language types, machine and assembly language concepts, fundamentals of data structures and algorithms. Mathematics through linear algebra, calculus of several variables, and discrete mathematics. GRE including advanced test in computer science. Applicants may submit, if they so desire, additional advanced GRE scores for consideration.

Program requirements for thesis option: 1) a minimum of 24 credits (exclusive of thesis) and a thesis; 2) at least 15 credits must be earned at the 500 level or above; 3) at least 18 credits must be from computer science courses; 4) completion of at least 6 credits in each of the following areas and 3 credits in each of the other two: architecture and systems—CSC 511, 512, 517; mathematical foundations—CSC 541, 542, 544; programming languages—CSC 501, 502.

Program requirements for nonthesis option: 1) a minimum of 30 credits, including at least one course with a substantial paper involving significant independent research; 2) at least 21 credits must be earned at the 500 level or above; 3) at least 24 credits must be from computer courses; 4) completion of at least 6 credits in each of two of the following areas and 3 credits in the third: architecture and systems—CSC 511, 512, 517; mathematical foundations—CSC 541, 542, 544; programming languages—CSC 501, 502; 5) passing a written comprehensive examination.

Doctor of Philosophy

Please see the listings under Applied Mathematical Sciences on page 24.

CSC Courses
Computer Science

402 (302) Compiler Design *(I or II, 3)*
406 Computer Graphics *(I or II, 3)*
411 Computer Organization *(I or II, 3)*
412 Operating Systems *(I or II, 3)*
420 (520) Software Engineering *(I or II, 3)*
436 (536) Database Management Systems *(I or II, 3)*
440 (540) Design and Analysis of Algorithms *(I or II, 3)*
445 (545) Formal Languages and Automata Theory *(I or II, 3)*

447 (or MTH 447) Discrete Mathematical Structures *(I or II, 3)*
450 (350) Fundamentals of Numerical Computation *(I or II, 3)*
481 Artificial Intelligence *(I or II, 3)*
491 Directed Study in Computer Science *(I and II, 1–3)*
492 Special Topics in Computer Science *(I or II, 3)*

501 Programming Language Semantics *(I or II, 3)* Design, analysis, implementation, and comparative study of major programming language families. Topics include procedural and block-structured languages, interpretive languages, concurrency, functional languages, object-oriented programming, logic programming, dataflow languages and machines. *(Lec. 3) Pre: 301 and 311.* Staff

502 Theory of Compilers *(I or II, 3)* An advanced course in compiler construction covering advanced parsing techniques, compiler-writing tools, type checking and type inference, code optimization, and compiling nonstandard language features. *(Lec. 3) Pre: 402.* Staff

511 Advanced Computer Organization *(I or II, 3)* Evaluation of high-performance computer systems with respect to architectures, operating systems, and algorithms. High-speed conventional machines; array processors; multiprocessors; data flow machines; RISC architectures; VLSI-based machines. *(Lec. 3) Pre: 411.* Staff

512 Topics in Operating Systems *(I or II, 3)* In-depth studies of topics chosen from the following list: concurrent programming, computer systems performance, and distributed systems. *(Lec. 3) Pre: 412.* Staff

517 Design and Analysis of VLSI Systems *(I or II, 3)* Illustration and analysis of VLSI algorithms and architecture. Emphasis on design of very large-scale integrated circuits, related methodologies, and theoretical foundations. VLSI technologies, fabrication, automated design tools for various problems. *(Lec. 3) Pre: 411 and 340 or 447.* Staff

525 (or IME 525) Simulation *(I or II, 3)* Discrete simulation models. Comparison of discrete change simulation languages. Methodology including generation of random variates, design of simulation experiments for optimization and validation of models and results. Selected applications. *Pre: 212 and 6 credits of statistics.* Staff

541 Design and Analysis of Algorithms II *(I or II, 3)* Advanced topics in the design and analysis of algorithms including combinatorial optimization and graph algorithms; computational geometry; primality and factoring, public-key cryptography; minimal comparison sorting; size and delay in switching circuits. *(Lec. 3) Pre: 440.* Staff

542 Mathematical Analysis of Algorithms *(I or II, 3)* Mathematical techniques for the analysis of algorithms. Sums and products; finite difference calculus; properties of binomial coefficients; Stirling, harmonic, and Fibonacci numbers; recurrence relations; generating functions; asymptotic approximation. Case studies. *(Lec. 3) Pre: 440.* Staff

544 Theory of Computation *(I or II, 3)* Automata and formal languages; undecidability; time and space complexity classes and relations between them; hierarchy and gap theorems; Savitch's theorem; alternating Turing machines; the complexity class NC. *(Lec. 3) Pre: 340 or 447.* Staff

547 Combinatorics and Graph Theory See Mathematics 547.

548 Topics in Combinatorics See Mathematics 548.

550 Advanced Numerical Computation *(I or II, 3)* Design of efficient numerical algorithms under various models of computation. Topics include polynomial and integer computations, computational linear algebra with applications to combinatorial optimization, lower bounds. *(Lec. 3) Pre: 450.* Staff

581 (or ELE 581) Special Topics in Artificial Intelligence *(I or II, 3)* Topics of specialized or current interest, which may change. Topics may include expert systems, natural language processing, neural network models, machine learning. AI applications in remote sensing. *(Lec. 3) Pre: 481 or permission of instructor. May be repeated with permission.* Staff

582 Robotics See Electrical Engineering 582.

583 Computer Vision See Electrical Engineering 583.

591 Directed Study in Computer Science *(I and II, 1–3)* Advanced work in computer science conducted as supervised individual projects. *Pre: permission of chairperson. S/U credit.* Staff

592 Special Topics in Computer Science *(I or II, 3)* Advanced topics of current interest in computer science. *(Lec. 3) Pre: permission of chairperson.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Economics
M.A.

Graduate Faculty

Chairperson: Associate Professor James L. Starkey, Ph.D., 1971, Boston College
Professor Harold Barnett, Ph.D., 1973, Massachusetts Institute of Technology
Professor Elton Rayack, Ph.D., 1957, University of Chicago
Associate Professor John P. Burkett, Ph.D., 1981, University of California, Berkeley
Associate Professor Leonard P. Lardaro, Ph.D., 1979, Indiana University
Associate Professor Arthur C. Mead, Ph.D., 1978, Boston College
Associate Professor Glenworth A. Ramsay, Ph.D., 1974, Boston College
Associate Professor Yngve Ramstad, Ph.D., 1981, University of California, Berkeley
Associate Professor Gilbert S. Suzawa, Ph.D., 1973, Brown University
Assistant Professor Richard McIntyre, Ph.D., 1988, University of Massachusetts
Assistant Professor Carole F. Miller, M.A., 1983, Syracuse University
Assistant Professor Mohammed Sharif, Ph.D., 1983, Boston University

Specializations

Economic development, economic theory, industrial organization, international economics, money and banking, public finance, econometrics, mathematical economics.

Master of Arts

Admission requirements: GRE (verbal and quantitative) and, normally, some undergraduate training in economics. Some training in mathematics and statistics is also desirable. Applicants are normally admitted for September only.

Program requirements: thesis or nonthesis option, 30 credits, including, for Track I, ECN 512, 527, 528, 575, 576, and 515 or 516 or thesis. This track is strongly advised for students desiring to pursue further studies in the mainstream of contemporary thought or to prepare themselves for professional work in business, government, and teaching at the university level. For Track II, ECN 512, 527, 528, and 515 or 516 or thesis. This track is available to students who prefer a wider range of courses and more freedom of choice. Track III is a terminal program in applied economics combined with training in an area of vocational or professional interest such as business administration, public administration, computer science, or community planning. The programs in this track will be designed separately for each individual student but must include one course with a substantial paper requiring significant independent research. For all tracks, the remaining credits required to complete a 30-credit program will be worked out with the major professor. The nonthesis option requires written comprehensive examination.

ECN Courses
Economics

402 Urban Economics *(I or II, 3)*
403 Corporate Crime and Government Regulation *(I or II, 3)*
404 Political Economy of Class, Race, and Gender *(I or II, 3)*
444 Applied Research in Economics *(II, 3)*
464 Comparative Economic Systems *(I or II, 3)*

512 History of Economic Analysis *(I, 3)* Advanced work on formative developments in economic thought from classical political economy to modern welfare economics. Emphasis on relationships between doctrines and their institutional setting. *(Lec. 3) Pre: permission of instructor.* Ramstad

515, 516 Economic Research *(I and II, 1–3 each)* Independent research. *S/U credit.* Staff

526 Economics of Labor Markets
See Labor and Industrial Relations 526.

527 Macroeconomic Theory *(II, 3)* Static and dynamic models of aggregate economic behavior developed and analyzed. *(Lec. 3) Pre: 327 and 375 or equivalent, or permission of instructor.* Mead

528 Microeconomic Theory *(I, 3)* Analytic tools of optimization. Neoclassical price and distribution theory. Linear programming and production theory. General equilibrium and welfare economics. *(Lec. 3) Pre: 328 and 375 or equivalent, or permission of instructor.* Suzawa

532 Industrial Organization and Public Policy *(II, 3)* Theoretical and empirical analysis of structure of industrial markets; behavior and performance of business firms in the American economy; government-business relationship and its effect on formulation of public economic policy. *(Lec. 3) Pre: 337 or permission of instructor.* Ramsay

534 Information Sources and Uses in Labor Relations and Labor Economics
See Labor and Industrial Relations 534.

538 International Economics *(I or II, 3)* Theory and evidence on international trade and finance. Includes determinants and welfare effects of foreign trade, international investment, migration, exchange rates, and the balance of payments. *(Lec. 3) Pre: 327 and 328 or permission of instructor.* Burkett

543 Public Finance and Fiscal Policy *(II, 3)* Analysis of private wants and public needs. Serves as introduction to a searching examination of such federal and federal-state fiscal problems as budgetary theory and procedures, tax theory, and reform. *(Lec. 3) Pre: 342 or permission of instructor.* Starkey

552 Monetary Theory and Policy *(II, 3)* Analysis of structure and functioning of monetary and banking systems; discussion of contemporary monetary theories; evaluation of monetary policies. *(Lec. 3) Pre: 334 or permission of instructor.* Barnett

566 Economic Planning and Public Policy in Developing Nations *(II, 3)* Resource and financial planning in public and private sectors of developing nations with emphasis on planning tools, allocation of domestic and foreign resources, and on national economic policies. *(Lec. 3) Pre: 327 and 363 or 464, or equivalent, or permission of instructor.* Sharif

575 Introduction to Mathematical Economics *(I, 3)* Application of basic quantitative methods to economic analysis. Dynamic and static economic models will be studied with emphasis on obtaining solutions. *(Lec. 3) Pre: 327, 328, and MTH 141 or permission of instructor.* Miller

576 Econometrics *(I, 4)* Application of statistics and mathematics to economic analysis. Implication of assumption required by statistical methods for testing economic hypotheses. Current econometric methods examined and discussed. *(Lec. 3) Pre: 575 or equivalent, EST 308 or equivalent, or permission of instructor.* Lardaro

590 Principles of Economics *(I and II, 3)* Survey of micro- and macroeconomic theory. *(Lec. 3) Graduate standing in MBA program.* Lardaro

595 Problems of Modernization in Developing Nations
See Resource Economics 595.

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

628 Advanced Microeconomic Theory *(II, 3)* Neoclassical value and distribution theory. Theories of imperfect competition, general equilibrium theory, and dynamic analysis. *(Lec. 3) Pre: 527 and 528 or permission of instructor.* Staff

630 (or REN 630) Resource Analysis *(I, 3)* Development and application of welfare theory to natural resource use. Welfare concepts such as consumer surplus, producer surplus, and marginal cost pricing in policy decisions for agriculture and natural resources. *Pre: 628 or permission of instructor. In alternate years. Next offered 1990-91.* Staff

676 (or REN 676) Advanced Econometrics *(I, 3)* A course covering the tools necessary for professional research in resource economics. Reviews the general linear model, but emphasis is on simultaneous equation models. Assumes a knowledge of introductory econometrics, statistical theory, and matrix algebra. *Pre: 576 or its equivalent.* Staff

690 National Income *(II, 3)* Advanced macroeconomic theory. *(Lec. 3) Pre: 126 or 590 or permission of instructor.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Economics–Marine Resources (Interdepartmental)

Ph.D. in Economics–Marine Resources

Please see listing under Resource Economics on page 95.

Education

M.A.

Graduate Faculty

Chairperson: Associate Professor Theodore Kellogg, Ph.D., 1971, Florida State University
Director of Graduate Studies: Professor Robert W. MacMillan, Ph.D., 1966, University of Texas, Austin

Adult Education
Professor William Croasdale, Ed.D., 1966, Teachers College, Columbia University
Assistant Professor John Boulmetis, Ph.D., 1982, Ohio State University

Educational Research
Professor John V. Long, Jr., Ph.D., 1971, Syracuse University
Professor Thomas R. Pezzullo, Ph.D., 1971, Boston College
Professor Richard F. Purnell, Ph.D., 1966, University of Texas

Elementary Education
Associate Professor Richard E. Sullivan, Ph.D., 1971, University of Texas, Austin
Assistant Professor Virginia Bartel, Ph.D., 1988, Virginia State University
Assistant Professor Susan L. Trostle, Ed.D., 1984, Pennsylvania State University

Reading Education
Professor Marguerite Bumpus, Ed.D., 1969, University of Massachusetts
Assistant Professor Arlene Mitchell, Ph.D., 1987, Pennsylvania State University
Assistant Professor Susan L. Trostle, Ed.D., 1984, Pennsylvania State University

Science Education
Professor William Croasdale, Ed.D., 1966, Teachers College, Columbia University
Associate Professor Theodore M. Kellogg, Ph.D., 1971, Florida State University

Secondary Education
Professor William Croasdale, Ed.D., 1966, Teachers College, Columbia University
Professor John V. Long, Jr., Ph.D., 1971, Syracuse University
Professor Francis X. Russo, Ph.D., 1964, Boston University
Professor George H. Willis, Ph.D., 1971, The Johns Hopkins University
Associate Professor Barbara Brittingham, Ph.D., 1973, Iowa State University
Associate Professor William L. McKinney, Ph.D., 1973, University of Chicago
Associate Professor Richard G. Nelson, Ph.D., 1972, University of Wisconsin

Enrollment of foreign students is limited; minimum TOEFL score of 600 is required.

The Master of Arts degree is offered in the following areas of study. Applicants should specify the area of specialization on the application form.

Adult Education

Admission requirements: MAT or GRE, teaching certificate or sound background in general education and/or social sciences, interview with program faculty.

Program requirements: thesis or nonthesis option. Twelve credits of core courses (EDC 505, 529, 583 and 584), 15 credits of electives structured into either a predefined subspecialization area or a unique subspecialization area designed in conjunction with the student's advisor. Predefined subspecializations include administration, adult literacy, gerontology, home economics education, training and development, and vocational-technical and extension education. Thesis or nonthesis seminar. Nonthesis option requires written comprehensive examination.

Counseling

See Human Development, Counseling, and Family Studies, page 56.

Educational Research

Admission requirements: MAT or GRE, teaching certificate, strong background in mathematics or statistics.

Program requirements: thesis; EDC 503, 514 or 574, 529, 570 or 571, PSY 410, 434, 510, 520, and one computer science elective.

Elementary Education

Admission requirements: MAT or GRE and teaching certificate, one year teaching experience or equivalent desirable.

Program requirements: thesis or nonthesis option. EDC 529, 570, 572 or 577; 21–24 credits including 3 credits of foundations, 3 credits of methods, 3 credits of free electives, 6 credits of thesis or nonthesis seminar and 3–6 credits taken outside of the Department of Education. Nonthesis option requires written comprehensive examination.

Reading Education

Admission requirements: MAT or GRE and teaching certificate, one year teaching experience or equivalent desirable.

Program requirements: thesis or nonthesis option. EDC 503; 529; 24 credit hours of courses approved for the preparation of reading specialists including a thesis or 6 credit hours of clinic or practicum experience, and one or more electives. Nonthesis option requires written comprehensive examination.

Science Education

Admission requirements: MAT or GRE and teaching certificate, undergraduate major in science, interview with faculty.

Program requirements: EDC 529; 12–18 credits of education electives including 6 credits of thesis or nonthesis seminar and a minimum of 12 credits in science. Nonthesis option requires a written comprehensive examination.

Secondary Education

Admission requirements: MAT or GRE and teaching certificate, one year's teaching experience desirable, undergraduate major in academic area of secondary education, interview with faculty.

Program requirements: thesis or nonthesis option. EDC 529; 571, 572 or 574; 3 credits of foundations; 6–12 credits of education, including six credits for thesis or nonthesis seminar and a minimum of 12 credits in the academic area. Nonthesis option requires the written comprehensive examination.

For Home Economics Education program, see listing on page 55.

For Teacher Certification, see page 101.

EDC Courses
Education

401 Development and Utilization of Instructional Materials *(I and II, 3)*
402 The Education of Special Needs Students *(I and II, 3)*
403 History of Education *(I, 3)*
407 Philosophy of Education *(I and II, 3)*
410 Seminar and Supervised Field Practicum in Education of the Aging *(I and II, 3)*
424 Teaching of Reading *(I and II, 3)*
425 The Use of Trade Books in the Reading Program *(I, 3)*
435 (or WRT 435) The Teaching of Composition *(I and II, 3)*
448 Reading in the Content Areas *(I, 3)*
478, 479 Problems in Education *(I and II, 0–3 each)*

500 Foundations of Adult Education *(I and II, 3)* Examination of fundamental structure, functions, problems, and history of adult education in America. Focus on socioeconomic factors and philosophical commitments that have shaped various programs. *(Lec. 3) Pre: graduate or senior standing and permission of instructor.* Russo and Boulmetis

501 Comparative Education in International Perspective *(I or II, 3)* Comparing foreign systems of education with particular emphasis on cultural developments and significant education experiences; sampling of national systems in Western Europe, USSR, Far East, East Africa, and South America. *(Lec. 3) Pre: senior or graduate standing.* Staff

502 The Modern Curriculum Movement *(I, 3)* Development of recent thinking of American curriculumists. The nature of curriculum development analyzed through the traditionalist, social scientific, and reconceptualist schools of thought. *(Lec. 3)* Willis

503 Education in Contemporary Society *(II, 3)* Leading educators' responses to issues and challenges confronting American education. Emphasis on identification and analysis of contemporary theories and practices reflecting the relationship between characteristics of society and educational values. *(Lec. 3)* Russo and Willis

504 Adult Basic Education *(I and II, 3)* Teaching of adults whose educational level is below high school completion. Physical, social, and psychological characteristics of disadvantaged adults and various techniques and materials useful in motivating and teaching them. *(Lec. 3) Pre: permission of instructor.* Staff

505 Leadership Development in Adult Programs *(I or II, 3)* Discussion of leadership concepts, styles, and implications. Discussion and practice in the use of several adult education methods and techniques for increasing the effectiveness of groups and organizations. *Pre: permission of instructor.* Staff

509 Critique of Public Policy in Human Services and Education *(I and II, 3)* Use of ideological assumptions in formulating and developing interpretive, normative, and critical perspectives on recent public policy proposals in various areas of human services and education. *(Lec. 3) Pre: permission of chairperson.* Willis and Russo

514 Current Trends in Elementary Education *(I, 3)* For teachers and administrators, the most effective use of instructional materials, media of communication, and personnel in elementary school. *(Lec. 3) Pre: 529 or permission of chairperson. In alternate years. Next offered 1989–90.* Staff

515 Discipline and Youth in Schools *(I or II, 3)* Seminar for teachers interested in classroom principles and techniques from research on discipline in public secondary schools. Will include dramatic role-playing by participants when feasible. *(Lec. 3) Pre: teacher certification or permission of instructor.* Purnell

516 Teaching English as a Second Language to Adults *(II, 3)* Methods and materials for educators who teach English as a second language to adults. *(Lec. 3) Pre: permission of instructor.* Staff

518 Teaching Science in the Elementary School *(I or II, 3)* Emphasis on the development, preparation, use, and evaluation of materials appropriate for the elementary classroom from biology, zoology, chemistry, physics, geology, astronomy, electricity, meteorology, and oceanography. *Pre: 12 credits in science.* Staff

520 Teaching of Arithmetic *(I, 3)* For the experienced teacher, examination of the principles underlying teaching of arithmetic in the elementary school, comprehensive survey of materials and methods available for the classroom teacher of arithmetic. *(Lec. 3) Pre: senior or graduate standing. In alternate years. Next offered 1990–91.* Staff

521 Teaching Basic Reading to Adults *(I or II, 3)* Techniques for teaching basic reading skills to illiterate adults; diagnosis, methods, and materials. *(Lec. 3) Pre: 504 or permission of instructor.* Staff

522 Microcomputer Applications in the Classroom *(I and II, 3)* Introduction to the use of microcomputers in elementary and secondary classrooms. History, current use, techniques for evaluating hardware and software, implementation issues, future developments. *(Lec. 3) Pre: senior or graduate standing.* Staff

528 Teaching Language Arts *(II, 3)* For the elementary school classroom teacher. Preparation, presentation, use, and evaluation of methods and materials for teaching the communications skills (emphasis on listening, speaking, and writing). *(Lec. 3) Pre: senior or graduate standing. In alternate years. Next offered 1990–91.* Staff

529 Foundations of Educational Research *(I and II, 3)* Analysis of the current major research approaches to educational problems with emphasis on interpreting published research involving the language of statistics. Functional skills in basic descriptive statistics needed prior to enrolling. *(Lec. 3)* Purnell

530 Qualitative Research and Evaluation *(I or II, 3)* Qualitative methods, including ethnography, for obtaining and using data in describing, interpreting, and reaching warranted judgments, particularly about educational and social problems. Emphasis on developing individual projects and writing formal reports. *(Lec. 3) Pre: permission of instructor.* Willis

531 School-Home Relations *(I or II, 3)* Seminar for school personnel, developmentalists, and family and community specialists interested in principles and techniques from research on school-home relations. *(Sem. 3) Pre: permission of instructor or teacher certification.* Purnell

534 Mathematics in the Secondary School *(II, 3)* Implementation of a modern mathematics program in the secondary school through a study of modern mathematics concepts, experimental programs, and instructional planning. *(Lec. 3) Pre: 15 credits in mathematics.* Croasdale

535 Classroom Observation and Evaluation *(I or II, 3)* Practicum in informal, naturalistic methods of observing and evaluating classrooms. Designed to increase teachers' and administrators' understanding of their own and others' classrooms in fostering individual and staff professional development. *(Lec. 2, Lab. 2) Pre: teaching experience, eligibility for teacher certification, or permission of instructor.* Willis

538 Teaching the Gifted and Talented *(I or II, 3)* Social, psychological, legal, and educational issues related to identification, selection, and instruction of gifted and talented students. *(Lec. 3) Pre: one undergraduate general psychology course, graduate standing, or permission of instructor.* Sullivan

539 Evaluation and Monitoring of Occupational Training Programs *(I or II, 3)* Evaluation and monitoring theory and practice for occupational training programs. Focus on development of systems for job training such as CETA, Vocational Education, and private sector programs. *(Lec. 3) Pre: 529 or permission of instructor.* Boulmetis

540 Learning Disabilities: Assessment and Intervention
See Psychology 540.

542 Methods for Challenging the Gifted Reader *(I and II, 3)* Providing challenging activities for gifted readers through interrelating reasoning with visual arts (viewing) and language arts (listening, speaking, reading, and writing). *(Lec. 3) Pre: 538 or permission of instructor.* Staff

561 Analysis of Reading Disabilities *(I, 3)* Causes of reading difficulties and the administration of diagnostic reading tests. Emphasis on construction and use of informal tests and standardized measures. Practice in analyzing data from case histories and in making individual case studies. *(Lec. 3, Lab. 2) Pre: 424 and permission of instructor.* Staff

562 Techniques in Remedial Reading *(II, 3)* Practices effective in teaching remedial reading in both the regular classroom and remedial clinics. Analysis of published materials. Methods of building new materials, discussion and demonstration of their practical application. *(Lec. 3, Lab. 2) Pre: 561 and permission of instructor.* Staff

563 Teaching Reading to Multicultural Populations *(I, 3)* Identification of the strengths of learners whose cultural and socioeconomic backgrounds vary, and the implications for teaching reading. Special emphasis on the selection and development of appropriate materials and teaching strategies. *(Lec. 3) Pre: 424 or permission of instructor.* Bumpus

565 Analysis and Evaluation of Current Research in Reading *(I, 3)* In-depth review of reading research on selected topics. Analysis of findings in historical perspective. Implications for reading teachers and reading programs. *(Sem. 3) Pre: 424 or permission of instructor. In alternate years. Next offered in 1989–90.* Staff

566, 567 Practicum in Reading *(I and II, 3 each)* Supervised case studies, practicum, and seminar reports on an individual reading project at either the elementary or secondary level. (120 hours plus seminar) *(Lec. and/or Lab. 3) Pre: 562 and permission of instructor.* Staff

569 Middle School Curriculum *(SS, 3)* Current middle school curriculum organization and materials with emphasis on the flexibility and integration of various content areas. *(Lec. 3) Pre: graduate standing.* Staff

570 Elementary School Curriculum *(II, 3)* Modern curriculum in the elementary school with emphasis on the needs of children. Covers language arts, social studies, science, arithmetic, and special subjects. *(Lec. 3) Pre: 503, 529 or equivalent. In alternate years. Next offered 1989–90.* Staff

571 The Secondary School Curriculum *(II, 3)* Intensive study of basic principles and procedures utilized in developing curriculum materials. Emphasis given to content of all curriculum areas in junior and senior high schools. *(Lec. 3) Pre: 503 and 529. In alternate years. Next offered 1990–91.* Staff

572 Cooperative Supervision *(I and II, 3)* Analysis of function, principles, and techniques of democratic cooperative supervision of teachers and other school officials. Application of these principles to supervisory problems of principals, heads of departments, special supervisors, and critic teachers. *(Lec. 3)* Staff

574 Current Trends in Secondary Education *(I and II, 3)* Effective use of instructional materials, media of communication, and organization of personnel and current research. *Pre: 529, 571 or permission of chairperson.* Staff

575, 576 Supervised Field Study and Seminar in Elementary or Secondary Education *(I and II, 3 each)* For nonthesis candidates. Lectures, seminars, and field work. Candidates plan and carry out a field study project approved by the instructor. The completed project report must be successfully defended during the semester. *Pre: admission to a master's program in education and permission of instructor.* Staff

577 Organization and Administration in Elementary School *(I, 3)* Functions and duties of elementary school principals. *(Lec. 3) In alternate years. Next offered 1989–90.* Staff

579 Labor Relations and Collective Bargaining in Education
See Labor Studies 579.

581 Administering Adult Programs *(I or II, 3)* Administration, personnel management, resource management, recruitment, staff development, and supervision within programs dealing with adults as learners. *(Lec. 3) Pre: 505 or permission of instructor.* Staff

582 Instructional Systems Development for Adult Programs *(I, 3)* Designing and implementing instructional systems. Discussion of the basic tenets underlying theories of instructional technology, curriculum development, and curriculum change as they apply to adult learners in a variety of settings. *(Lec. 3) Pre: 580 or 581 or permission of instructor.* Staff

583 Planning, Design, and Development of Adult Learning Systems *(I, 3)* Overview of the program planning process including goal setting, needs analysis, program planning, and implementing change strategies. Discussion of effective functioning in the role of change agent within an organization. *(Lec. 3) Pre: permission of instructor.* Staff

584 The Adult and the Learning Process *(I and II, 3)* Examination of the adult as a learner with emphasis on the factors that affect adult learning and learning processes related to instruction. *(Lec. 3) Pre: 581 or permission of instructor.* Staff

585 Seminar on Leadership for Youth and Adult Programs *(II, 3)* Students will participate in a nonstructured group to observe the emergence of leadership and the effects of individual behavior on the self and others. *(Lec. 3) Pre: graduate standing in education and permission of instructor.* Staff

586, 587 Problems in Education *(I and II, 0–3 each)* Advanced work for graduate students in education. Courses conducted as seminars or as supervised individual projects. *(Lec. or Lab.) Pre: permission of chairperson. May be repeated for credit with different topic.* Staff

588, 589 Supervised Field Practicum and Seminar in Youth and Adult Education *(I and II, 3 each)* Leadership principles and practices applied in selected clinic systems. (200 practicum hours are required in addition to the seminar) *(Lec. 2, Lab. 3) Pre: 582, 583, or 584 and 529, or permission of instructor.* Staff

594 Organization and Supervision of Reading Programs *(II, 3)* Various roles of the reading specialist in relation to the other line-staff personnel. Problems concerning the orientation of new teachers, reading research and development, in-service programs, and community support. *(Lec. 3) Pre: 562. In alternate years. Next offered 1989–90.* Staff

596 Organization Development in Education
See Human Development, Counseling, and Family Studies 562.

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

905 Improving Home and School Communications *(SS, 3)* Study of techniques and knowledge for development of programs to improve home and school communications. *Pre: permission of instructor.* Purnell and Bumpus

930 Workshop in Chemistry Topics for Teachers
See Chemistry 930.

ADE Courses
Adult and Extension Education

488 Methods and Materials for Adult Extension Education *(I and II, 3)*
491, 492 Special Problems in Adult Education *(I and II, 1–3 each)*

RDE Courses
Resource Development Education

444 (or EDC 444) Teaching Agribusiness and Natural Resources *(I, 3)*
486 Internship *(I and II, 1–6)*

Electrical Engineering
M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Allen G. Lindgren, Ph.D., 1962, University of Connecticut
Professor James C. Daly, Ph.D., 1967, Rensselaer Polytechnic Institute
Professor Leland B. Jackson, Sc.D., 1970, Stevens Institute of Technology
Professor Gabriel Lengyel, Ph.D., 1964, University of Toronto
Professor Shmuel Mardix, Ph.D., 1969, University of Jerusalem
Professor Shashanka S. Mitra, Ph.D., 1957, University of Michigan
Professor Charles Polk, Ph.D., 1956, University of Pennsylvania
Professor Angaraih G. Sadasiv, Ph.D., 1963, Purdue University
Professor John E. Spence, Ph.D., 1962, University of Wisconsin
Professor Donald W. Tufts, Sc.D., 1960, Massachusetts Institute of Technology
Associate Professor Steven M. Kay, Ph.D., 1980, Georgia Institute of Technology
Associate Professor G. Faye Boudreaux-Bartels, Ph.D., 1983, Rice University
Associate Professor Ramdas Kumaresan, Ph.D., 1982, The University of Rhode Island
Associate Professor William Ohley, Ph.D., 1976, State University of New York, Stony Brook
Associate Professor Harish R.B. Sunak, Ph.D., 1974, University of Southampton
Associate Professor Peter F. Swaszek, Ph.D., 1982, Princeton University
Associate Professor Richard J. Vaccaro, Ph.D., 1983, Princeton University
Assistant Professor Godi Fischer, Ph.D., Swiss Federal Institute of Technology in the Institute of Telecommunications
Assistant Professor Ying Sun, Ph.D., 1985, Worcester Polytechnic Institute
Assistant Professor Jan Zeman, Ph.D., 1985, Swiss Federal Institute of Technology
Assistant Professor Qing Yang, Ph.D., 1988, University of Southwestern Louisiana
Adjunct Professor Albert S. Most, M.D., 1962, The Johns Hopkins University
Adjunct Associate Professor Roy K. Aaron, M.D., 1969, State University of New York
Adjunct Associate Professor Pranab K. Banerjee, Ph.D., 1971, The University of Rhode Island
Adjunct Assistant Professor David O. Williams, M.D., 1969, Hahnemann Medical College

Specializations

Acoustics and underwater acoustics: information processing in acoustic channels, speech processing, modeling of electroacoustical devices.

Biomedical engineering: physiologic systems modeling and control; medical instrumentation employing digital computer techniques, pattern recognition and image processing in medicine (texture analysis, image classification, and segmentation); biological effects of electric and magnetic fields at the cellular level.

Computer engineering and VLSI: microprogramming systems, multiprocessing, high-speed signal processing; processor realization using VLSI; MOS layout and microchip design; data structures and computer architectures.

Communication theory: statistical and computer communications; vector quantization; noise modeling and detection; data compression and coding; local area networks, reliable and secure communication.

Digital signal processing: detection and parameter estimation; prediction and filtering; spectrum analysis; array processing; digital filter synthesis; adaptive filtering, algorithm design.

Electrical and optical properties of materials: optical properties of nonmetallic solids, laser-matter interaction, photocathodes; crystallographic techniques for submicron X-ray lithography; radiation damage in nonmetallic solids.

Electromagnetic fields and optical communication: numerical and approximate methods for calculation of electromagnetic fields in inhomogeneous and anisotropic structures (related to biological effects of electromagnetic fields); evaluation of mode characteristics in optical and infrared waveguides.

Systems theory: control and estimation theory; multivariable systems; nonlinear systems, robotics and intelligent control, modeling of deterministic and stochastic systems; model order reduction; optimal smoothing, filtering, and prediction; computerized imaging systems and image analysis.

Master of Science

Admission requirements: GRE and B.S. in electrical engineering, engineering science, physics, mathematics, or computer science. Preparation in related fields such as aeronautical, civil, chemical, and mechanical engineering or in the life sciences may be acceptable.

Program requirements: thesis or nonthesis option. Individual programs are designed in accordance with the students' backgrounds and interests, but the thesis option requires permission of the chairperson. Thesis or nonthesis option: minimum of 30 credits in science and engineering with a minimum of 18 credits in electrical engineering or in other areas of science and engineering. Attendance at the departmental seminar (ELE 601, 602) is required of all students in graduate residence. Programs of study require departmental and Graduate School approval. In the nonthesis option a written master's examination and one course involving significant independent research and a substantial paper are required.

Doctor of Philosophy

Admission requirements: GRE and M.S. degree or equivalent in electrical engineering, engineering science, physics, mathematics, or computer science.

Program requirements: qualifying examination may be required. For the comprehensive examination, a background in several of the following areas is required—linear and nonlinear systems, communication and control systems, design of digital systems, electromagnetic theory, and solid-state physics. Most students find it essential to become thoroughly familiar with the application of digital computer techniques. Attendance at the departmental seminar (ELE 601, 602) is required of all students in graduate residence. Dissertation research makes use of major modern laboratories in the listed areas of specialization.

ELE Courses
Electrical Engineering

401 Lasers, Optical Systems, and Communications *(I, 4)*
405 Digital Computer Design *(II, 3)*
408 Computer Organization Laboratory *(II, 3)*
427 Systems Laboratory: Modelling *(I, 4)*
432 Electrical Engineering Materials *(II, 4)*
436 Communication Systems *(I, 3)*
437 Computer Communications *(II, 3)*
443 Electronics II *(I, 5)*
444 Electronics III: Pulse and Digital Circuits *(II, 4)*
457 Feedback Control Systems *(I, 3)*
458 Systems Laboratory: Digital Control *(II, 4)*
481, 482 Biomedical Engineering Seminar I, II *(I and II, 1 each)*
491, 492, 493 Special Problems *(I and II, 1 each)*
495 Electrical Engineering Practice I *(I, II, or SS, 3)*
496 Electrical Engineering Practice II *(II, 6)*

501 Linear Transform Analysis *(I, 3)* Fourier and Laplace transform analysis of continuous-time systems, causality and spectral factorization, evaluation of inverse transforms, z-transform analysis of discrete-time systems, Hilbert transforms, discrete Fourier transforms, generalized transforms. *(Lec. 3)* Staff

502 Nonlinear Systems Analysis *(I and II, 3)* Iteration and perturbation techniques, phase-plane and state-space concepts, Liapunov's direct method, stability criteria for nonlinear systems. *(Lec. 3) Pre: 501 or equivalent.* Staff

503 (or MCE 503) Linear Control Systems *(I or II, 3)* State-variable description of continuous-time and discrete-time systems, matrices and linear spaces, controllability and observability, pole-placement methods, observer theory and state reconstruction, modern control systems design. *(Lec. 3) Pre: 313 or MCE 366 or equivalent.* Staff

504 (or MCE 504) Optimal Control Theory *(II, 3)* Quadratic performance indices and optimal linear control, frequency response properties of optimal feedback regulators, state estimation, separation theorem, optimal control of nonlinear systems, Pontryagin's minimum principle. *(Lec. 3) Pre: 503.* Staff

506 Digital Signal Processing *(II, 3)* Digital representations of signals and noise; sampling and aliasing; design of digital-processing systems for signal parameter estimation and signal detection; digital filter structures; discrete Fourier transform and FFT algorithm, periodogram. *(Lec. 3) Pre: 501 and 509.* Staff

509 Systems with Random Inputs *(I or II, 3)* Discrete and continuous linear systems with random inputs. Introduction to random processes in the context of linear systems. Applications to detection, smoothing, and prediction. *(Lec. 3) Pre: knowledge of differential equations, linear systems, and transform methods.* Staff

510 Communication Theory *(II, 3)* Communication theory for discrete and continuous channels. Optimum-receiver principles and signal design. Channel models, modulation techniques, data compression, speech and image coding, architecture and topology of communication networks. *(Lec. 3) Pre: 509.* Staff

511 Electromagnetic Fields *(I, 3)* Review of electrostatics and magnetostatics. Maxwell's equations, wave propagation in dielectric and conducting media. Boundary phenomena. Radiation from simple structures. Relations between circuit and field theory. *(Lec. 3)* Staff

513 Solar to Electric Energy Conversion *(II, 3)* Review of the theory of thermal radiation. Collection of radiant energy as heat and direct conversion to electricity. Concentration on photovoltaic solar cells. *(Lec. 3) Pre: 331 or equivalent and permission of instructor.* Staff

515 Quantum Electronics *(I or II, 3)* Laser engineering and applications, interaction of radiation with atoms, optical resonators, electro-optic modulation, harmonic generation, parametric oscillation and frequency conversion, noise in laser amplifiers and oscillators. *(Lec. 3) Pre: PHY 341 or permission of instructor.* Staff

520 Fourier Optics *(I or II, 3)* Application of Fourier analysis in optical imaging and data processing. Systems concepts are stressed. Scalar diffraction, lenses, coherent and incoherent imaging, spatial filtering and optical information processing, and holography. *(Lec. 3) Pre: 313 or equivalent basic knowledge of Fourier analysis.* Staff

525 Fiber Optic Communication Systems *(II, 3)* Survey of important topics in optical communication devices and systems. The physical principles and operation of lasers, LEDs, fibers, and detectors are covered. *(Lec. 3) Pre: 323, 331, 401 or equivalent.* Lengyel

526 Fiber Optic Sensors *(II, 3)* Theory and performance of different types of intensity-, phase-, and polarization-modulated fiber optic sensors (FOS) and their application areas. Properties of various active and passive devices used in building FOS. *(Lec. 3) Pre: 401 or equivalent and permission of instructor.* Sunak

527 Current Topics in Lightwave Technology *(I, 3)* Current topics of importance in lightwave technology including coherent fiber optical communication systems, optical amplifiers, active and passive single-mode devices, infrared optical fibers. Material will be taken from recent literature. *(Lec. 3) Pre: 525 or equivalent and permission of instructor.* Sunak

531 Solid State Engineering I *(I and II, 3)* Periodicity of solids; dielectric, thermal, optical, and electromagnetic properties of electronically interesting solids. *(Lec. 3) Pre: 331 or equivalent.* Staff

532 Solid State Engineering II *(I and II, 3)* Semiconductor physics, transport properties. Applications including solid state lasers, piezoelectric, ferroelectric, and magnetic devices. *(Lec. 3) Pre: 531 or equivalent.* Staff

536 Semiconductor Electronics *(I or II, 3)* Theory and technology of semiconductor devices. Junction, field effect, optoelectronic and microwave devices. Integrated circuits. *(Lec. 3) Pre: 331 or equivalent.* Sadasiv

537 VLSI System Design *(I or II, 3)* Very large-scale integration. Silicon technology;

MNOS, CNOS, and bipolar devices; circuits, and digital subsystems; computer-aided design and analysis of VLSI circuits; VLSI and digital system architecture. *(Lec. 3) Pre: graduate standing or senior standing with permission of instructor.* Sadasiv

538 Principles of Remote Sensing *(I or II, 3)* Theory and techniques of remote sensing including spaceborne photometry and radiometry. Applications selected from the following topics: planetary atmospheres, geology and earth resources, environmental problems. *(Lec. 3) Pre: 323, PHY 406, or permission of instructor.* Staff

539 Analog VLSI *(I or II, 3)* Theory and techniques of analog MNOS and CNOS integrated circuits. Device modeling, circuit simulation, and chip design are studied using amplifiers, A/Ds, and switched-capacitor circuits as examples. *(Lec. 3) Pre: 537.* Daly

544 Computer Arithmetic for VLSI *(II, 3)* Review of number systems and computer arithmetic: hardware implementation of fixed- and floating-point adders, multipliers and dividers; VLSI implementation of residue arithmetic finite fields; error analysis and time/gate complexity of arithmetic operations. *(Lec. 3) Pre: 405.* Kumaresan

545 Design of Digital Circuits *(I, 3)* Design techniques for digital computers and controllers. Combinatorial and sequential circuits, minimization techniques, fast arithmetic circuits, memory and control circuits, floating-point hardware, Turing machines, coders and decoders, microprogramming, sequence generators. *(Lec. 3) Pre: 405 or equivalent.* Staff

546 Computer-Based Instrumentation *(I, 3)* Design of memory systems, input-output techniques, direct memory access controllers, instrument buses, video displays, multiprocessors-coprocessors, real-time operations, device handler integration into high-level language and mass storage. *(Lec. 2, Lab. 3) Pre: 205, 314, and concurrent enrollment in 405.* Ohley and Sun

548 Computer Architecture *(I and II, 3)* Hardware architecture of modern minicomputers and microcomputers. Instruction sets, memory organization, peripheral interfacing and control, bus structures, microprogramming, microcomputer systems, techniques for real-time operation, software aids and requirements. *(Lec. 3) Pre: 405 or CSC 311 or equivalent.* Staff

571 (or OCE 571) Underwater Acoustics I *(I, 3)* Wave equation, energy, pressure and particle velocity. Acoustic properties of the sea. Elementary sources, refraction, reflection, ray theory, normal modes and scattering, with emphasis on sound propagation in the ocean. *(Lec. 3)* Stepanishen

581 Special Topics in Artificial Intelligence See Computer Science 581.

582 (or CSC 582 or MCE 582) Robotics *(I or II, 3)* Description, design, and control of industrial and research robots. Tactual and visual sensing systems. Computer control of manipulators. Object descriptions for manipulation. Obstacle avoidance. Applications. *(Lec. 3) Pre: knowledge of matrix algebra and Laplace transforms or permission of instructor.* Staff

583 (or CSC 583) Computer Vision *(I, 3)* Algorithms used to extract information from two-dimensional images. Picture functions. Template matching. Region analysis. Contour following. Line and shape descriptions. Perspective transformations. Three-dimensional reconstruction. Image sensors. Interfacing. Applications. *(Lec. 3) Pre: MTH 362 or equivalent.* Staff

584 (or EST 584) Pattern Recognition *(II, 3)* Random variables, vectors, transformations, hypothesis testing, and errors. Classifier design: linear, nonparametric, approximation procedures. Feature selection and extraction: dimensionality reduction, linear and nonlinear mappings, clustering, and unsupervised classification. *(Lec. 3) Pre: 509, CSC 410 or introductory probability and statistics, and knowledge of computer programming.* Staff

588 Biomedical Engineering I *(I, 3)* Modeling of biosystems. Electrical properties of biological materials. Electrocardiography, vectorcardiography. Models of nerve propagation. *(Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing.* Staff

589 Biomedical Engineering II *(II, 3)* Mechanical properties of biological materials. Application of ultrasound to medical diagnosis and treatment. Hemodynamics, pulmonary and renal dynamics. Artificial organs. *(Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing.* Staff

591, 592 Special Problems *(I and II, 1–3 each)* Advanced work under supervision of a staff member arranged to suit individual requirements of student. *Pre: permission of chairperson. May be repeated for a maximum of 6 credits.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

601, 602 Graduate Seminar *(I and II, 1 each)* Seminar discussions including the presentation of papers based on research or detailed literature surveys. *(Lec. 1) Required of all resident graduate students with a maximum of 1 credit per year allowed. May be repeated for a maximum of 2 credits. S/U credit.* Staff

606 Digital Filter Synthesis *(I, 3)* Review of z-transforms and discrete-time systems, properties of digital-filter networks, design of finite and infinite-impulse-response filters, accuracy considerations for coefficients and data, hardware implementation, system examples. *Pre: 506 or equivalent.* Jackson

616 Advanced Topics in Electromagnetic Theory *(II, 3)* Electromagnetic theory of inhomogeneous and anisotropic media. Ferrite devices. Introduction to the theory of plasmas. Ionospheric radio propagation. *(Lec. 3) Pre: 511 or equivalent.* Daly or Polk

625 Guided Waves in Optical and IR Fibers *(I, 3)* Guided electromagnetic wave aspects of optical and IR fibers, novel approximation methods for solution of vectorial and scalar wave equations in optical fibers, theory of transparency and nonlinear optical interactions in solids as applied to design of optical fibers. *(Lec. 3) Pre: 511 and 525.* Mitra

651 Feedback Control Systems *(I, 3)* Analysis of synthesis of complex control systems. Extension of feedback control theory to handle random disturbances, sampled data, and nonlinearities. System optimization. *(Lec. 3) Pre: 457 or equivalent.* Staff

660 Advanced Topics in System Theory *(I or II, 3)* Seminar for advanced students. Selected topics of current research interest. Material will be drawn primarily from recent literature. *(Lec. 3) Pre: permission of instructor.* Staff

661 Estimation Theory *(I or II, 3)* Extraction of information from discrete and continuous data, best linear estimation, recursive estimation, optimal linear filtering, smoothing and prediction, nonlinear state and parameter estimation, design and evaluation of practical estimators. *(Lec. 3) Pre: 503 and 509.* Staff

665 Modulation and Detection *(I or II, 3)* Advanced treatment of modulation and detection theory. Minimum meansquare error, maximum likelihood, and maximum posterior probability estimators. Applications to communications systems and to radar and sonar systems. *(Lec. 3) Pre: 510.* Kay or Tufts

670 Advanced Topics in Signal Processing *(I or II, 3)* Seminar for advanced students. Selected topics of current research interest. Material will be drawn primarily from recent literature. *(Lec. 3) Pre: 506 and 606.* Staff

672 (or OCE 672) Underwater Acoustics II *(II, 3)* Transducers, radiators and receivers, directivity (array structures), equivalent circuits, efficiency; piezoelectricity, magnetostriction, sonar principles, measurements and calibration. *(Lec. 3)* Stepanishen

691, 692 Special Problems *(I and II, 1–3 each)* Advanced work under supervision of a staff member arranged to suit individual requirements of a student. *Pre: permission of chairperson. May be repeated for a maximum of 6 credits. S/U credit.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

English
M.A., Ph.D.

Graduate Faculty

Acting Chairperson: Professor Dorothy F. Donnelly, Ph.D., 1979, Brandeis University
Acting Director of Graduate Studies: Professor Richard T. Neuse, Ph.D., 1959, Yale University
Professor Josie P. Campbell, Ph.D., 1972, Pennsylvania State University
Professor Lois Cuddy, Ph.D., 1975, Brown University
Professor Mark I. Goldman, Ph.D., 1959, University of Minnesota
Professor Don R. Kunz, Ph.D., 1968, University of Washington
Professor Allan H. MacLaine, Ph.D., 1951, Brown University
Professor Francis X. Mathews, Ph.D., 1964, University of Wisconsin
Professor Clare M. Murphy, Ph.D., 1964, University of Pittsburgh
Professor Daniel D. Pearlman, Ph.D., 1968, Columbia University
Professor Paul J. Petrie, Ph.D., 1957, State University of Iowa
Professor Jules P. Seigel, Ph.D., 1965, University of Maryland
Professor David C. Stineback, Ph.D., 1969, Yale University
Professor Tom H. Towers, Ph.D., 1971, Tulane University
Professor Sidney H. White, Ph.D., 1962, University of Southern California
Associate Professor Paul G. Arakelian, Ph.D., 1975, Indiana University
Associate Professor Diedre Badejo, Ph.D., 1985, University of California, Los Angeles
Associate Professor Walter L. Barker, Ph.D., 1966, University of Connecticut
Associate Professor Walter Cane, Ph.D., 1966, Vanderbilt University
Associate Professor Wilfred P. Dvorak, Ph.D., 1972, Indiana University
Associate Professor Mathilda M. Hills, Ph.D., 1970, Duke University
Associate Professor Dorothy Jacobs, Ph.D., 1968, University of Michigan
Associate Professor John R. Leo, Ph.D., 1972, Northwestern University
Associate Professor Marilyn J. Malina, Ph.D., 1967, University of Virginia
Associate Professor Celest A. Martin, Ph.D., 1979, University of Southern California
Associate Professor Thomas H. McCabe Ph.D., 1968, University of Wisconsin
Associate Professor RB Reaves, Jr., Ph.D., 1971, University of Wisconsin
Associate Professor Eric T. Schoonover, A.M., 1959, University of Michigan
Associate Professor Robert A. Schwegler, Ph.D., 1977, University of Chicago
Associate Professor Karen F. Stein, Ph.D., 1982, University of Connecticut
Associate Professor M. Beverly Swan, Ph.D., 1977, Boston University
Associate Professor Ralph M. Tutt, Ph.D., 1966, Duke University
Assistant Professor Sally F. Burke, Ph.D., 1978, University of Connecticut
Assistant Professor William L. Mensel, Jr., Ph.D., 1974, University of Washington
Professor Emeritus Thomas A. Gullason, Ph.D., 1953, University of Wisconsin
Professor Emeritus Jordan Y. Miller, Ph.D., 1957, Columbia University
Professor Emerita Nancy A. Potter, Ph.D., 1954, Boston University; L.H.D., 1967, The University of Rhode Island
Professor Emeritus Robert P. Sorlien, Ph.D., 1955, Brown University
Professor Emerita Edna L. Steeves, Ph.D., 1948, Columbia University

Specializations

For the M.A. and for the Ph.D.: all historical periods, genres, and major authors in British and American literature; Scots and Irish literature; critical theory; rhetoric and composition studies. *In addition, for the M.A. only:* linguistics.

Master of Arts

Admission requirements: GRE and a minimum of 21 credits in English with a B average in all English courses. The specialization in rhetoric and composition studies requires WRT 512, 535, and ENG 680, 681.

Program requirements: 24 credits plus thesis (6 credits); *OR* 30 credits (including two 600-level seminars) plus a comprehensive examination based on a departmental reading list.

Doctor of Philosophy

Admission requirements: GRE with subject test (Literature in English) and M.A. in English or equivalent.

Program requirements: reading knowledge of one foreign language, unless waived by student's doctoral committee in consultation with the director of graduate studies. 24 credits (including four 600-level seminars) plus 18 credits of dissertation research. Written comprehensive examination in four areas (various options available: historical periods, genres, major authors, crossdisciplinary studies). Oral comprehensive examination in area of specialization. At least one course must be taken in each historical period in which a student does *not* write a comprehensive examination (courses taken for the M.A. may fulfill this requirement). The specialization in rhetoric and composition studies requires WRT 512, 535, and ENG 680, 681.

ENG Courses
English

445 Ethnic Images in American Literature *(II, 3)*
446 Modern Drama *(I and II, 3)*
447 Modern British and American Poetry *(I and II, 3)*
448 Traditions of the American Novel *(I and II, 3)*
458 Traditions of the British Novel *(I and II, 3)*
468 Traditions of the Continental Novel *(I and II, 3)*
469 The Modern Novel *(I and II, 3)*
472 Shakespeare's Plays *(I and II, 3)*
474 (or AAF 474) Topics in Pan-African Literature *(II, 3)*
477 Traditions of British Drama *(I and II, 3)*
485 American Authors *(I or II, 3)*
486 British Authors *(I or II, 3)*

510 Bibliography and Literary Research *(I or II, 3)* Use of descriptive and analytical bibliography, various modes of literary criticism, and other scholarly tools in the solution of literary research problems. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1992.* Steeves

530 History of the English Language *(I, 3)* Historical study of development of English syntax, sounds, vocabulary, and usage. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1991.* Arakelian

531 History of Critical Theory *(I, 3)* Important critical theories from Aristotle to the twentieth century. Emphasis on orientation of theories to various aspects of the literary situation. Some study of modern attitudes toward earlier critics. *(Lec. 3) Pre: senior or graduate standing or permission of instructor. Next offered fall 1989.* Murphy

532 Modern Literary Criticism *(I, 3)* Dominant modes and schools of criticism exemplified by T.S. Eliot, T.E. Hulme, I.A. Richards, Edmund Wilson, John Crowe Ransom, and other important critics. Pertinent related literary works. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1991.* Staff

534 Structure of the English Language *(I or II, 3)* Synchronic study of American morphology, phonology, and syntax, and the application of linguistic methodology to the teaching and analysis of literature and composition. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1991.* Arakelian

535 Old English *(II, 3)* Introduction to the language and literature. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1992.* Mensel

536 Problems in Linguistics and Literature *(I or II, 3)* Recent developments in linguistics and their application to the study of literature. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1989.* Arakelian

540 Modern American Novel *(I, 3)* Important American novelists of the twentieth century with emphasis on major developments in ideas and techniques. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1991.* Staff

545 Problems in American Realism and Naturalism *(I, 3)* Readings, discussions, and papers on stylistic, thematic, and philosophic issues relating to literary artists like Howells, James, Crane, Dreiser, Hemingway, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1990.* Towers

546 Problems in American Romanticism *(I, 3)* Major themes and works of such authors as Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1989.* Cuddy

547 Early American Literature to 1800 *(II, 3)* Thorough examination of colonial and federal literature, some discussion of beginnings of Romanticism. Special attention to Taylor, Edwards, Franklin, Fremeau, and Charles Brockden Brown. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1992.* Towers

549 Modern American Poetry *(I or II, 3)* In-depth study of several major American poets, such as Eliot, Pound, Frost, Stevens, Williams, and others; or of a school such as the Imagists, the Fugitives, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1990.* Goldman

550 Middle English Literature *(I or II, 3)* Selections from Middle English literature exclusive of Chaucer. Works by Malory, the Pearl Poet, Gower, the Wakefield Master, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1990.* MacLaine

551 The Metaphysical Poets *(I, 3)* Intensive analysis and interpretation of poetry of Donne, Herbert, Vaughan, Crashaw, and Marvell. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1989.* Jacobs

554 Modern British Poetry *(I, 3)* In-depth study of several major British poets, such as Yeats, Lawrence, Auden, Thomas, MacNeice, and others; or of a school such as the War Poets (WW I), and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1990.* Goldman

555 Modern British Novel *(I, 3)* Important British novelists of the twentieth century with emphasis on major trends in ideas and techniques. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1992.* McCabe

556 English Literature of the Sixteenth Century *(II, 3)* Early humanism. Tudor poetry and its continental antecedents. Satire and translation. Elizabethan voyage literature. Writers chosen from More, Erasmus, Skelton, Wyatt, Surrey, Sidney, Spenser, Marlowe, Hakluyt, Lodge, Shakespeare, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1990.* Hills

557 English Literature of the Seventeenth Century *(I, 3)* Selected poets and prose writers, studied for their contribution to the dominant themes and modes of expression of the Stuart and Cromwellian eras. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1990.* Jacobs

558 English Literature of the Eighteenth Century *(II, 3)* Intensive study of major and selected minor figures of the eighteenth century. Emphasis on verse and nonfiction prose, some attention to developments of the drama. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1990.* Reaves

559 English Literature of the Romantic Period *(I, 3)* Selections from the major works and writers of the Romantic Movement. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1991.* Petrie

560 English Literature of the Victorian Period *(II, 3)* Selections from the major works and writers of the Victorian period. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1991.* Dvorak

561 Modern European Novel *(II, 3)* Major developments in the European novel during the twentieth century. Special attention to Proust, Mann, Kafka, Moravia, Silone, Lagerkvist, Malraux, and Camus. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1990.* Staff

570 Anglo-Irish Writers *(II, 3)* The Celtic Renaissance as a literary movement, its importance and influence. AE, Lady Gregory, Joyce, O'Casey, O'Flaherty, Stephens, Synge, Yeats, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1991.* Staff

571 Problems in Chaucer *(II, 3)* Intensive study of selected aspects of Chaucer's achievements as a poet. Emphasis on *The Canterbury Tales. (Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1990.* MacLaine

573 Problems in Shakespeare *(II, 3)* Primarily a discussion course, concentrating on plays and characters that offer most interesting problems for student analysis. Solutions by leading critics are examined. *(Lec. 3) Pre: permission of instructor. Next offered spring 1991.* Campbell

574 The Scots' Poetic Tradition through Robert Burns *(II, 3)* Intensive study of the poetry of Robert Burns, Ferguson, Ramsay, and others who sparked the Scottish revival. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1990.* MacLaine

575 Modern Southern Literary Renaissance *(II, 3)* Comprehensive study of a major literary movement. Representative works by Faulkner, Wolfe, Warren, Williams, Porter, Welty, O'Connor, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1991.* Tutt

576 English Novel of the Eighteenth Century *(II, 3)* Selected novels of Defoe, Richardson, Fielding, Smollett, Sterne, and Austen, with consideration of major criticism and of disparate influences on the emergence of the novel. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1991.* Reaves

577 English Novel of the Nineteenth Century *(II, 3)* Important British novelists of the nineteenth century with emphasis on trends in ideas and techniques of Victorian novelists. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1990.* Dvorak

578 Problems in Milton *(II, 3)* Emphasis on the major poetic works. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1990.* Neuse

590 Selected Topics *(I and II, 3)* Selected topics in American and British literature and topics of special interest not covered by traditional department offerings. *(Lec. 3) Pre: graduate standing or permission of instructor. Fall 1989: Creative Writing—Fiction.* Pearlman *Spring 1990: Creative Writing—Poetry.* Petrie

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

The 600-level (seminar) courses include: specialized topics, intensive readings, occasional lecture, and frequent presentation of ongoing research by students. A substantial research project and permission of the chairperson are required.

640, 641 Seminar in American Literature before 1900 *(I and II, 3 each)* Staff

642, 643 Seminar in Modern Literature (American) *(I and II, 3 each) Fall 1989: Modernization of Quest-Romance.* Heller *Spring 1990: Twentieth Century Women Writers.* Cuddy

650, 651 Seminar in English Literature of the Middle Ages *(I and II, 3 each)* Staff

652, 653 Seminar in English Literature of the Sixteenth Century *(I and II, 3 each)* Staff

654, 655 Seminar in English Literature of the Seventeenth Century *(I and II, 3 each)* Staff

656, 657 Seminar in English Literature of the Eighteenth Century *(I and II, 3 each) Fall 1989: The Sublime.* Leo

658, 659 Seminar in English Literature of the Nineteenth Century *(I and II, 3 each)* Staff

660, 661 Seminar in Modern Literature (English) *(I and II, 3 each)* Staff

670, 671 Seminar in Special Literary Problems *(I and II, 3 each)* Readings in literature which present special problems not

addressed by traditional department offerings. Seminar topics may be offered from time to time based on student request. *(Lec. 3) Fall 1989: Medieval Literature—Reading against the Text.* Campbell *Spring 1990: Modern Drama.* Jacobs

680, 681 Seminar in Special Rhetorical Problems *(I and II, 3 each)* Readings in rhetoric which present special problems not addressed by traditional department offerings. Seminar topics may be offered from time to time based on student request. *(Lec. 3) Pre: graduate standing or permission of instructor. Fall 1989: Critical Approaches to Dickens, Woolf, and Walker.* Dvorak and Schwegler

691, 692 Independent Graduate Study *(I and II, 3 each)* Advanced study of an approved topic under the supervision of a staff member. *(Lec. 3) Pre: permission of chairperson.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

WRT Courses
Writing

435 (or EDC 435) The Teaching of Composition *(I and II, 3)*

512 Modern Rhetorical Theory *(I, 3)* An introduction to theories of rhetoric and their relation to literature and language. Includes D'Angelo, Kinneavy, Winterowd, Perelman, Booth, and Burke. Pertinent related literary works. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1989.* Schwegler

535 Theories and Strategies in the Teaching of Writing *(II, 3)* An introductory course in theories and pedagogy of rhetoric. Readings and lectures cover the current research in composition, including such areas as ESL and business or technical communications. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1990.* Staff

999 Methods of Teaching College Writing *(I and II, 0)* Materials and multiple methods of teaching writing on the college level. Required of teaching assistants who will teach in the College Writing Program unless waived by the director of English graduate studies, the supervisor of teaching assistants, and the director of the College Writing Program. Staff

Experimental Statistics

See Statistics on page 100.

Fisheries, Aquaculture, and Pathology

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Associate Professor Murn M. Nippo, Ph.D., 1976, The University of Rhode Island
Professor Pei Wen Chang, Ph.D., 1965, Yale University
Professor Thomas L. Meade, Ph.D., 1953, University of Florida
Professor Richard E. Wolke, Ph.D., 1968, University of Connecticut
Associate Professor Terence M. Bradley, Ph.D., 1983, University of Idaho
Associate Professor Joseph T. DeAlteris, Ph.D., 1986, College of William and Mary
Associate Professor H. Glenn Gray, Ph.D., 1966, Cornell University
Associate Professor Richard I. Millar, M.S., 1959, The University of Rhode Island
Associate Professor Conrad W. Recksiek, Ph.D., 1972, University of Maine
Associate Professor Richard C. Rhodes, Ph.D., 1980, Texas A&M University
Assistant Professor Michael A. Rice, Ph.D., 1987, University of California, Irvine
Adjunct Associate Professor John Gentile, Ph.D., 1966, University of New Hampshire

Specializations

Fisheries and aquaculture (M.S. only): aquaculture of salmonids and shellfish; genetics, nutrition, and physiology of fishes; fisheries science, and technology.

Animal virology: characterization of avian and marine viral infections; recovery of viruses from inland estuaries, streams, and ponds.

Aquatic pathology: pathology of aquatic animals; effects of environmental pollution on marine organisms.

Animal and veterinary science (M.S. only): regional and national problems are studied in the areas of physiology, endocrinology, nutrition, behavior, and health. Both domestic livestock and laboratory animals are used in a research context.

Master of Science

Admission requirements: GRE and an undergraduate major in biological sciences with a concentration in animal science, marine biology, microbiology, or zoology; one year of organic chemistry and physics. Courses in statistics, histology, and physiology are strongly recommended.

Program requirements: animal virology—thesis and ASP 501, 502, 534, 536; BCP 581, 582; MIC 432, 533.

Fisheries and aquaculture—thesis and coursework selected in consultation with the major professor and chairperson.

Aquatic pathology—thesis and ASP 486, 501, 502, 534, 536, 555, 556; EST 409; suggested courses include ASP 483, 584, 586; MIC 432.

Animal and veterinary science—animal-related research, thesis, and oral defense of thesis. A minimum of 24 credits (exclusive of a minimum of 6 thesis credits) are required and are determined by student interests and background with the approval of the major professor. Enrollment in two semesters of ASP 501, 502 is required, and attendance is mandatory.

Doctor of Philosophy (Biological Sciences)

Limited to animal virology and marine pathology specializations.

Admission requirements: same as for master's degree; Ph.D. qualifying examination.

Program requirements: animal virology—courses listed under M.S. degree and ASP 538, MIC 552, 641, suggested courses include BCP 622, 624; marine pathology—courses listed under M.S. degree and BCP 581, 582, MIC 533, suggested courses include ASP 538, 584, 586, BCP 622, 624, MIC 532.

ASP Courses
Aquacultural Science and Pathology

401 Introduction to Pathology *(I, 3)*
452 Industrial Fishery Technology *(I, 3)*
476 The Genetics of Fish *(I, 3)*
483 Salmonid Aquaculture *(I, 3)*
486 Applied Physiology of Fish *(II, 3)*

501, 502 Seminar *(I and II, 1 each)* Preparation and presentation of scientific papers on selected subjects in animal pathology and virology. Staff

532 Experimental Design
See Experimental Statistics 532.

534 (or MIC 534) Animal Virology *(I, 3)* Basic properties, classification, and evolution of animal viruses. Individual agents are studied in detail. *(Lec. 3) Pre: MIC 432, 533, and permission of chairperson.* Chang

536 (or MIC 536) Virology Laboratory *(I, 2)* Methods employed in diagnosis and for the investigation of the biological, physical, and chemical properties of animal viruses. *(Lab. 6) Pre: credit or concurrent enrollment in 534.* Chang

538 (or MIC 538) Epidemiology of Viral and Rickettsial Diseases *(II, 2)* Principles of epidemiology. Interrelationships of host, environment, and agent in viral and rickettsial diseases. *(Lec. 2) Pre: credit or concurrent enrollment in 534. In alternate years. Next offered 1989–90.* Chang

555, 556 Pathology Rotation *(I and II, 3 each)* Applied anatomical and clinical pathology of aquatic animals including necropsy duty and/or clinical hematology, chemistry,

microbiology, parasitology. Attendance at weekly histopathology seminar and research/case report required. *(Lab. 6) Pre: a course in histology or ZOO 323, MIC 432, and/or permission of instructor. In alternate years. Next offered 1990–91.* Wolke

584 Advanced Aquaculture Systems *(II, 3)* Development of design criteria, operational analysis, and management of selected species in water reuse systems. *(Lec. 2, Lab. 2) Pre: MIC 361 or equivalent or permission of instructor. In alternate years. Next offered 1989–90.* Meade

586 Fish Nutrition *(I, 3)* Digestion and metabolism of carbohydrate, protein, and lipids by fish. Role of vitamins and minerals in metabolism and associative nutritional diseases resulting from deficiencies. Inadvertent toxic factors in fish feeds. *(Lec. 3) Pre: 412 and CHM 228 or equivalent. In alternate years. Next offered 1989–90.* Meade

591, 592 Special Projects *(I and II, 1–3 each)* Research projects in animal pathology, virology, and aquaculture. *Pre: permission of chairperson.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

AVS Courses
Animal and Veterinary Science

412 Animal Nutrition *(I, 3)*
420 Animal Breeding and Genetics *(II, 3)*
462 Laboratory Animal Techniques *(II, 3)*
463 Animal Veterinary Technology *(II, 3)*
472 Physiology of Reproduction *(II, 3)*
491, 492 Special Projects *(I and II, 1–3 each)*

591, 592 Research Problems *(I and II, 3 each)* Research problems to meet individual needs of graduate and honors students in the field of animal breeding, nutrition, or physiology and food science. *(Lab. 6, TBA) Pre: permission of chairperson.* Staff

FST Courses
Fisheries Science and Technology

415 (FMT) Fishery Science *(I, 3)*
421 (FMT) Theory of Fishing Gear Design *(I, 3)*
431 (FMT) Vessel Casualty Prevention *(II, 3)*
480 (FMT) Mid-Ocean Navigation *(I, 3)*

510 (FMT) Marine Fisheries Ecology *(I, 3)* A study of the interaction between the marine environment and the fisheries, the effects of the environment on individual fish, the life histories of fish, fish behavior, and fish migration. *(Lec. 3) Pre: 415, OCG 401, or permission of instructor.* DeAlteris

516 (FMT) Early Life History of Aquatic Resource Animals *(II, 3)* Biology and ecology of juvenile and planktonic commercially important species; dynamics of reproduction, fecundity, growth, distribution, and behavior as modulated by the physical environment; identification, enumeration, and sampling. *(Lec. 2, Lab. 3) Pre: 415 and EST 408.* Recksiek

518 (FMT) Marine Fisheries Technology *(I, 3)* The commercial resource, its exploitation and use. Capture techniques and equipment. Aspects of commercial activities, fishing vessel operations and technology. *(Lec. 3) Pre: permission of instructor.* Recksiek

521 (FMT) Fishing Gear Technology *(II, 3)* Evaluation of fishing gear behavior and performance using theoretical model-scaling and statistical analysis techniques. Field and laboratory measurement procedures. *(Lec. 3) Pre: credit or concurrent enrollment in 518 and permission of instructor.* DeAlteris

591, 592 (FMT) Special Problems *(I and II, 1–3 each)* Advanced work under the supervision of a staff member arranged to suit individual needs of students in various fields of fisheries and marine technology. *(Lec. and/or Lab. according to nature of problem) Pre: permission of chairperson.* Staff

Food Science and Nutrition

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Arthur G. Rand, Jr., Ph.D., 1964, University of Wisconsin
Graduate Coordinator: Professor Richard W. Traxler, Ph.D., 1958, University of Texas
Professor Spiros M. Constantinides, Ph.D., 1966, Michigan State University
Professor Clifford J. Cosgrove, M.S., 1957, The University of Rhode Island
Professor Henry A. Dymsza, Ph.D., 1954, Pennsylvania State University
Professor Chong Min Lee, Ph.D., 1974, The University of Rhode Island
Professor Kenneth L. Simpson, Ph.D., 1963, University of California
Associate Professor Marjorie J. Caldwell, Ph.D., 1972, Cornell University
Associate Professor Ruth E. Eshleman, Ed.D., 1975, Columbia University Teachers College
Associate Professor Murn M. Nippo, Ph.D., 1976, The University of Rhode Island
Assistant Professor Catherine English, M.S., 1982, University of Vermont
Assistant Professor Leonard Gerber, Ph.D., 1980, University of Illinois
Assistant Professor Karen Koenig, Ph.D., 1988, Virginia Polytechnic Institute and State University
Assistant Professor Michael Morrissey, Ph.D., 1983, University of Oregon
Adjunct Professor Edward S. Josephson, Ph.D., 1940, Massachusetts Institute of Technology
Adjunct Professor Arthur M. Kaplan, Ph.D., 1948, University of Massachusetts
Adjunct Professor Gerald Silverman, Ph.D., 1954, Cornell University
Adjunct Assistant Professor Kathleen Gianquitti, M.S., 1981, The University of Rhode Island
Professor Emeritus Clinton O. Chichester, Ph.D., 1954, University of California

Specializations

Food science: marine fish utilization by preservation and product development, seafood quality assessment, fabricated surimi-based products; food quality control and safety; food engineering; environmental microbiology; biotechnology applications of bioprocessing; biochemical and physical properties of foods; and international food technology.

Nutritional science: nutritional status and food habits of population groups; vitamin A and provitamin A analysis and metabolism; nutrition policy; nutrition for athletes and in weight control—diet and exercise; aquacultural nutrition; nutrition and computers in foodservice management; and international nutrition.

Dietetics Experience Certificate Program

Admission requirements: cumulative undergraduate grade point average of 3.00 or better; an earned bachelor's degree with completion of the American Dietetic Association (ADA) Plan IV/V program requirements; and the ADA Verification Statement or ADA Declaration of Intent Form from their Plan IV/V program director. Six credits of acceptable coursework in the discipline beyond the bachelor's degree are required for applicants whose bachelor's degrees were completed prior to 1984; at least 12 credits are required if the bachelor's degree was completed prior to 1979. Completion of the graduate school application form and Preprofessional Practice Program Application (AP4) are required. Criteria used for admission include a balance of: a) academic achievement; b) relevant work experience; c) statement of purpose; and d) professional recommendations. Admission is for the fall term only, and preference will be given to Rhode Island residents. Fall 1990 enrollment is expected to be limited to 12 students. The deadline for the receipt of all application materials for fall 1990 admission is April 15, 1990. Applications not complete as of April 15 cannot be considered.

Program requirements: The Dietetics Experience Certificate Program is an ADA-approved preprofessional practice program (AP4) and is administered under the department's nondegree status. The program consists of 46 weeks of coursework and planned experiences in health care facilities in Rhode Island.

Master of Science

Admission requirements: GRE and bachelor's degree with adequate preparation in biochemistry, statistics, and in the area of proposed study. Students from other academic backgrounds are encouraged to apply, but some basic courses may have to be taken for no program credit.

Program requirements: thesis; FSN 503; 2 credits of FSN 511; a minimum of 3 credits in biochemistry, chemistry, microbiology, or physiology; a minimum of 6 credits in food science (FSN 431 plus one 500-level course). If the student has taken FSN 431 or 441 as an undergraduate, alternate courses should be taken in the same area. All resident students are expected to be continuously registered in a seminar as FSN 511 or 512, but no more than 2 credits of FSN 511 can be used for program credit.

Doctor of Philosophy

Admission requirements: master's degree in a physical or biological science is normally required. Students from other academic backgrounds are encouraged to apply, but some basic courses may have to be taken for no program credit.

Program requirements: same as master's degree plus statistics (EST 532 or equivalent), a total of 3 credits in FSN 511, and a research problem (FSN 691, 692) under the supervision of an advisor other than the major professor. Each candidate shall also gain teaching experience in at least one college-level course. All resident students are expected to be continuously registered for FSN 511 or 512, but no more than 3 credits of FSN 511 can be used for program credit. Qualifying examination is required for students admitted without a master's degree or without a strong background in the proposed area of study.

FSN Courses
Food Science and Nutrition

421 Food Analysis *(I, 4)*
422 (or MIC 422) Biotechnology of Industrial Microorganisms *(II, 3)*
431 Biochemistry of Food *(I, 3)*
432 Food Processing *(II, 3)*
433 Food Quality *(II, 3)*
434 Marine Food Processing *(II, 4)*
438 Food Chemistry Laboratory *(I, 3)*
441 Advanced Human Nutrition *(I, 3)*
444 Nutrition and Disease *(II, 3)*
447 (or CHE 447) Food Engineering I *(I, 4)*
456 Community Nutrition *(II, 4)*
461 Food Safety *(II, 3)*
491, 492 Special Projects *(I and II, 1–3 each)*

502 Physical Chemistry and Properties of Food *(I, 3)* Principles of physical chemistry and properties of food material. Analysis of changes in physical properties and interaction of food components during physical processing. Application of underlying principles in food formulation and processing. *(Lec. 2, Lab. 2) Pre: 431 or permission of chairperson.* C. Lee

503 Food Science and Nutrition Research Methods *(I, 4)* Theory and practice in techniques and methods as applied to research in food science and nutritional science. *(Lec. 1, Lab. 6) Pre: permission of chairperson.* Simpson

511 Food Science and Nutrition Seminar I *(I and II, 1)* Reports and discussions of current topics in food science and nutrition, as well as oral reports of theses and dissertation research topics in progress. *(Lec. 1) Pre: graduate standing or permission of chairperson.* Staff

512 Food Science and Nutrition Seminar II *(I and II, 1)* Critical review of oral presentations presented in 511. Provides student with experience in communicative skills necessary to evaluate and critique scientific presentations. Attendance is required of all graduate students in residence when not enrolled in 511. *(Lec. 1) Pre: graduate standing. S/U credit.* Staff

523 Water Pollution Microbiology
See Microbiology 523.

525 Water Pollution Microbiology Laboratory
See Microbiology 525.

526 (or MCH 526) Lipid Chemistry *(I, 3)* Advanced course in the chemistry of biologically important lipids such as the fatty acids, neutral glycerides, phospholipids, steroids, and the chemistry and biochemistry of the carotenoids. *(Lec. 3) Pre: BCP 581. In alternate years. Next offered 1989–90.* Gerber, Simpson, and Turcotte

532 Seafood Quality *(II, 3)* Biochemical and microbiological deterioration of seafoods, methods utilizing these reactions for quality assessment, and processes to inhibit these reactions for preservation of fresh seafoods. *(Lec. 1, Lab. 4) Pre: 421, 432 or permission of instructor. In alternate years. Next offered 1989–90.* C. Lee

542 Minerals and Vitamins *(II, 3)* Recent research in minerals and vitamins as related to human nutrition. Discusses the interrelationship between minerals, vitamins, and other nutrients as they relate to nutrition status. *(Lec. 3) Pre: 441 or permission of chairperson. In alternate years. Next offered 1989–90.* Gerber

545 Protein Nutrition *(II, 3)* Advanced course in protein nutrition emphasizing recent findings and research methodology; focus on comparative aspects of human and animal nutrition. *(Lec. 3) Pre: credit in 441 or AVS 412 or permission of instructor. In alternate years. Next offered 1990–91.* Caldwell and Nippo

548 Separations for Biotechnology
See Chemical Engineering 548.

549 Food and Biochemical Engineering III
See Chemical Engineering 549.

550 Issues in International Nutrition *(I, 3)* Nutrition related problems of developing countries. Causes and consequences of undernutrition and evaluation of methods for treatment and prevention. Current issues in international nutrition. *(Lec. 3) Pre: graduate standing, 207 or permission of instructor. In alternate years. Next offered fall 1989.* Caldwell

591, 592 Special Research Problem *(I and II, 1–4 each)* Advanced work under supervision of a staff member. Arranged to suit individual requirements of students. *Pre: permission of chairperson.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

691, 692 Research in Food Science and Nutrition *(I and II, 1–3 each)* Assigned research on an advanced level. Students are required to outline the problem, conduct the necessary literature survey and experimental work, and to present their observations and conclusions in a report. Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

French
M.A.

Graduate Faculty

Chairperson: Professor Otto Dornberg, Ph.D., 1966, Ohio State University
Section Head and Director of Graduate Studies: Professor Armand B. Chartier, Ph.D., 1970, University of Massachusetts, Amherst
Professor Kenneth H. Rogers, Ph.D., 1970, Columbia University
Professor H. Dorothy Rothschild, Ph.D., 1959, Columbia University
Professor Harold A. Waters, Ph.D., 1956, University of Washington
Associate Professor Ira A. Kuhn, Ph.D., 1970, University of Kansas
Associate Professor Joseph G. Morello, Ph.D., 1968, University of Missouri
Associate Professor Constantin Toloudis, Ph.D., 1969, Rice University
Assistant Professor JoAnn Hammadou, Ph.D., 1988, The Ohio State University
Professor Emeritus Lambert C. Porter, Docteur es lettres, 1953, University of Paris, University of Toulouse

Specializations

French studies which include French literature, French-Canadian literature, Black-French studies, linguistics.

Master of Arts

Admission requirements: GRE or MAT, 24 credits or equivalent of French, of which a minimum of 9 must be in literature.

Program requirements: thesis—eight 500-level courses and a comprehensive examination; nonthesis—ten 500-level courses including one course with a major paper requiring significant independent research, and comprehensive examination. A maximum of 9 credits from 400-level courses may be counted toward the thesis or the nonthesis program.

FRN Courses
French

402 French Phonetics *(II, 3)*
411 Medieval Literature *(I, 3)*
422 Sixteenth-Century Literature *(I or II, 3)*
433 Seventeenth-Century Literature *(II, 3)*
443 Eighteenth-Century Literature *(I, 3)*
453 Nineteenth-Century Literature until 1848 *(I, 3)*
454 Nineteenth-Century Literature since 1848 *(I, 3)*
461 Twentieth-Century Theatre *(II, 3)*
465 Twentieth-Century Prose *(I, 3)*
473 French-Canadian Literature *(II, 3)*
474 Black Literature in French *(II, 3)*
480 Business French *(I or II, 3)*
497, 498 Directed Study *(I and II, 3 each)*

501 Advanced Composition *(II, 3)* Stylistics to prepare undergraduate and graduate French majors to write expository French prose. *(Lec. 3) Pre: graduate status or permission of instructor. In alternate years.* Staff

503 History of the French Language *(II, 3)* Linguistic development of French from the earliest documents to the present. Gallo-Romance dialects; the spread of French in and beyond Europe. *(Lec. 3) Pre: graduate status or permission of instructor.* Rogers

Note: Courses 513–594 include lectures, discussions, readings, individual research, and a research paper.

513 Seminar in Medieval Literature *(I, 3) Pre: graduate standing or permission of instructor.* Staff

523 Seminar in Sixteenth-Century Literature *(I, 3) Pre: graduate standing or permission of instructor.* Rothschild

533 Seminar in Seventeenth-Century Literature *(I, 3) Pre: graduate standing or permission of instructor.* Morello

544 Seminar in Eighteenth-Century Literature *(II, 3) Pre: graduate standing or permission of instructor.* Rothschild

554, 555 Seminar in Nineteenth-Century Literature *(I and II, 3 each) Pre: graduate standing or permission of instructor.* Touloudis and Chartier

564 Seminar in Modern Poetry *(I, 3) Pre: graduate standing or permission of instructor.* Waters

565 Seminar in Twentieth-Century Theatre *(II, 3) Pre: graduate standing or permission of instructor.* Waters or Kuhn

566 Seminar in Twentieth-Century Prose *(I, 3) Pre: graduate standing or permission of instructor.* Touloudis

594 Special Topics *(I and II, 3)* Group and/or individual investigation of special problems in French language, literature, and civilization. *Pre: acceptance of project by a staff member and permission of the chairperson.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Geography

Pending a reorganization of the programs, applicants for the Master of Arts in Geography are advised to apply for the M.A. in marine affairs. For this program and a listing of the courses available, please see page 65.

Geology
M.S.

Graduate Faculty

Chairperson: Professor Jon C. Boothroyd, Ph.D., 1974, University of South Carolina
Professor and State Geologist J. Allan Cain, Ph.D., 1962, Northwestern University
Professor O. Don Hermes, Ph.D., 1967, University of North Carolina
Associate Professor Reinhard K. Frohlich, Ph.D., 1966, University of Clausthal-Zellerfeld
Associate Professor Daniel P. Murray, Ph.D., 1976, Brown University
Assistant Professor David E. Fastovsky, Ph.D., 1986, University of Wisconsin

Specializations

Sedimentology: emphasis on field projects—a) measurement of Recent barrier, lagoonal and estuarine processes, and investigation of lithofacies; b) Recent braided rivers and alluvial fans; c) depositional systems of ancient rocks.

Stratigraphypaleontology: paleoenvironmental reconstructions, historical geology, paleontology, paleobiology.

Coastal geomorphology: analysis of coastal land-forms using field techniques, remote sensing aerial and satellite imagery. Emphasis on Rhode Island barriers, Cape Cod, and barrier islands of the Atlantic coast.

Glacial geology: sedimentary aspects of Pleistocene and Recent glacial paleoenvironments of New England and Alaska; environmental mapping.

Geohydrology: analysis of geologic factors affecting groundwater quantity and quality, utilizing geologic and hydrologic mapping, subsurface geoelectric and surface-flow field surveys and environmental impact studies.

Applied geophysics: near-surface geophysics such as geoelectrics, gravity, and refraction seismic for groundwater and related topics. Gravity and magnetics related to structural and plutonic geology in southern New England.

Remote sensing: applied remote sensing using optical and computer analysis of satellite imagery and aerial photography in geomorphology, and coastal, structural, planetary, and environmental geology.

Petrology–geochemistry: field and laboratory petrologic studies in the New England Appalachians and elsewhere, including petrogenesis of volcanic, plutonic, and metamorphic rocks.

Structure and tectonics: deformation at regional and microscopic scales; relationship between deformation and metamorphism; emphasis on New England tectonics.

Planetary geology: origin and history of chasms, channels, and valleys of Mars.

Resource and environmental studies: relevant aspects of the above specializations.

Individual programs may include courses and/or research in conjunction with the Graduate School of Oceanography and other departments; interdisciplinary studies are encouraged.

Master of Science

Admission requirements: GRE and bachelor's degree in science or engineering. By the end of the first year, students lacking an undergraduate major equivalent to the bachelor of science degree in geology will be required to demonstrate, through coursework and/or qualifying examinations, comparable knowledge of geology and related fields.

Program requirements: thesis, oral comprehensive examination, departmental seminar (for no program credit), defense of thesis.

GEL Courses
Geology

401 Ore Deposits *(II, 3)*
410 Geomorphology *(I, 4)*
422 Intermediate Mineralogy and Petrology *(I, 3)*
440 Introduction to Paleontology *(I, 4)*
450 Introduction to Sedimentation and Stratigraphy *(I, 4)*
465 Introduction to Geophysics *(I, 3)*
485 (or CVE 485) Engineering Geophysics *(II, 3)*
487 Quantitative Geology *(II, 3)*

510 Coastal Geomorphology *(II, 3)* Coastal development and interpretation in relation to endogenetic and exogenetic shore

processes. Experimental model wave tank studies and applied field studies. *(Lec. 3) Pre: 410, 450, or permission of instructor. Offered in spring of odd calendar years.* Staff

512 Geologic Terrain Remote Sensing *(II, 3)* Application of remote sensing to terrain analysis, utilizing photo-optical instrument analysis of satellite imagery, aerial photography, radar, and multispectral imagery of geomorphologic, coastal, geohydrologic, structural, environmental, and extraterrestrial terrains. *(Lec. 2, Lab. 2) Pre: 303 or 410 or permission of instructor. Offered in spring of even calendar years.* Staff

515 Glacial Geology *(I, 3)* Investigation of late Cenozoic glaciation including areas with presently existing glaciers. Primary stress on sedimentology and geomorphology of glacial deposits. Field trips in New England area. *(Lec. 2, Lab. 2) Pre: 450 or permission of instructor.* Boothroyd

530 Igneous Petrology *(II, 3)* Tectonic and chemical bases for igneous phenomena stressing the association concept of igneous activity. Evaluation of the criteria used in petrogenetic interpretations. *(Lec. 2, Lab. 3) Pre: 321 or permission of instructor. Offered in spring of even calendar years.* Hermes

531 Metamorphic Petrology *(I, 3)* Facies concept and other methods of interpreting metamorphic mineral assemblages. Chemical and fabric changes during metamorphism, including principles of structural petrology. *(Lec. 2, Lab. 3) Pre: 321 or permission of instructor.* Murray

550 Sedimentary Processes *(II, 3)* Physical and chemical processes of sedimentation with emphasis on fluvial, beach, and estuarine environments. Stress on field applications of theory, with independent project and reading. *(Lec. 3) Pre: 450 or permission of instructor. Offered in spring of odd calendar years.* Boothroyd

553 Basin Analysis *(II, 3)* A depositional systems and facies model approach to interpretation of sedimentary rocks. In-depth study of various ancient depositional basins using models developed from recent sedimentary environments. Field trips. *(Lec. 3) Pre: 450 or permission of instructor. Offered in spring of even calendar years.* Boothroyd

554 Sedimentary Petrology *(I, 3)* The detailed interpretation of siliciclastic and carbonate fabrics and textures in thin section and hand sample. Emphasizes aspects of diagenesis, including cementation, replacement, recrystallization, pedogenesis, and porosity evolution. Skeletal elements and paleoenvironmental context presented. *(Lec. 2, Lab. 2) In alternate years. Next offered 1990–91. Pre: 440 and 450 or permission of instructor.* Fastovsky

565 Advanced Interpretation in Applied Geophysics *(II, 3)* Interpretation of geophysical data using theoretical models. Reflection, refraction, and surface propagation of seismic energy. Computer analysis of gravity and magnetic potential data. DC geoelectrical potential over horizontally stratified medium. *(Lec. 2, Lab. 2) Pre: MTH 243, PHY 214, or equivalent course in physics with permission of instructor. Offered in spring of odd calendar years.* Frohlich

570 Structural Analysis *(I, 3)* Mapping and geometric analysis of structures in variably deformed terrains. *(Lec. 1, Lab. 4) Pre: 321, 370, 480, or permission of instructor. Offered in fall of even calendar years.* Murray

571 Structural Petrology *(II, 3)* The evolution of rock fabric as a consequence of deformation and metamorphism. *(Lec. 2, Lab. 1) Pre: 321, 370, or permission of instructor. Offered in spring of odd calendar years.* Murray

577 Coastal Geologic Hazards *(II, 3)* Geologic hazards in the coastal zone and their impact on society. Includes waves, storm-surge, mass-wasting, and sea level rise. Geologic effectiveness of engineering structures and management techniques. Emphasis on field study. *(Lec. 2, Lab. 3) Pre: 450 or permission of instructor. Offered in spring of even calendar years.* Boothroyd

580 New England Geology *(I, 3)* Review of the bedrock geology of New England, and its applications for the Appalachian/Caledonides mountain chain and theories of orogenesis. Mandatory field trips. *(Lec. 3) Pre: 104, 321, 370, or permission of instructor. Offered in fall of odd calendar years.* Murray

581 (or OCG 581) Topics in Tectonic Geology *(I, 3)* Review of selected topics in continental and oceanic tectonics. *(Sem. 3) Pre: permission of instructor. Offered in fall of even calendar years.* Murray and Fox

585 Geohydrology *(I, 3)* Groundwater hydrology and drainage basin analysis related to geomorphology, glacial geology, and environmental impact. Analysis of water resources in various geologic environments. Geophysical methods of investigation. *(Lec. 3) Pre: 302 or 410 and 450 and permission of instructor. Offered in spring of even calendar years.* Veeger

588 Advanced Geological Evolution of North America *(II, 4)* The evolution of major sedimentary basins of North America in their tectonic framework. Includes advanced readings in the primary literature and 10-day field trip to southern Appalachians. *Pre: concurrent audit and coursework in 488 and permission of instructor.* Fastovsky and Boothroyd

590 Special Problems *(I and II, 1–3)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. and/or Lab. according to the nature of the problem) Pre: permission of instructor.* Staff

591 Special Problems *(I and II, 1–3)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. and/or Lab. according to the nature of the problem) Pre: permission of instructor. S/U credit.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

930 Workshop in Geology Topics for Teachers *(I and II, 0–3 each)* Especially designed for teachers of physical sciences. Basic topics of geology from an advanced or pedagogical perspective. *Pre: teacher certification.* Staff

Note: for other related courses see OCG 540, 544, 545, 625, 628, 629, 641, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 678, 681 and CVE 587, 588, 677, 681, 685, 686.

Gerontology

Acting Director: Associate Professor Phillip Clark, Sc.D., 1979, Harvard University

The gerontology program blends a strong and comprehensive gerontological background with the various professional skills offered in six University master's degree programs. It is designed to prepare professional practitioners to serve their older clients with a high level of excellence and understanding. The program is limited to 15 new students annually with acceptance into one of the following degree programs as a prerequisite: education (adult education); home economics education; human development, counseling, and family studies; nursing; physical education; textiles, clothing, and related art. Please see the listing of the above programs to determine admission and program requirements.

Although scholarship and interest in the problems of aging are primary factors in considering applicants, every effort will be made to choose students from various disciplines for each entering group. Each student is expected to develop a thorough understanding of four basic areas:

1. the processes of aging in the human being, including physiological and psychomotor changes and the psychological effects of those processes on the individual;
2. the social setting in which the aging individual lives and operates and the consequences of his interaction with this environment;
3. the overall organization of society including extended family structures and the private and state agencies which serve the aging specifically or which deal with elderly clients as part of a larger population served;
4. the prevailing cultural ideologies, including persistent myths and stereotypes of aging, and how these collective beliefs

influence the quality of life of the aged.

In addition to the program requirements listed under the participating degree program, specialization requirements include: SOC 438 Aging in Society or PED 564 Physiology of Aging; HCF 520 Developmental Issues in Later Adulthood; a third course to be taken within the student's individual degree program which addresses the issues of aging in relation to the skills or knowledge of that discipline. Each student must also participate in a common practicum seminar and complete at least 6 credits of research or practicum specified in the program requirements for the participating department.

History
M.A.

Graduate Faculty

Chairperson: Professor Joel A. Cohen, Ph.D., 1967, University of Connecticut
Director of Graduate Studies: Assistant Professor Gino Silvestri, Ph.D., 1969, Syracuse University
Professor Josiah M. Briggs, Ph.D., 1962, Columbia University
Professor Frank Costigliola, Ph.D., 1973, Cornell University
Professor James F. Findlay, Jr., Ph.D., 1961, Northwestern University
Professor Robert M. Gutchen, Ph.D., 1966, Columbia University
Professor Chong Sun Kim, Ph.D., 1965, University of Washington
Professor Maurice N. Klein, Ph.D., 1965, Emory University
Professor Sharon H. Strom, Ph.D., 1969, Cornell University
Professor Gary Thurston, Ph.D., 1973, Columbia University
Professor Robert G. Weisbord, Ph.D., 1966, New York University Graduate School
Assistant Professor Charles E. Daniel, Jr., Ph.D., 1968, Ohio State University
Assistant Professor Mariano Diaz-Miranda, Ph.D., 1988, University of Texas, Austin
Assistant Professor Michael W. Honhart, Ph.D., 1972, Duke University
Assistant Professor Teresa Murphy, Ph.D., 1982, Yale University
Adjunct Associate Professor Albert T. Klyberg, M.A., 1963, University of Michigan
Professor Emeritus William D. Metz, Ph.D., 1945, University of Wisconsin
Professor Emeritus Daniel H. Thomas, Ph.D., 1934, University of Pennsylvania

Specializations

History of the United States; history of Europe; Third World history. These three areas of specialization include courses in: American, diplomatic, East Asian, African, black, Latin American and women's history; imperialism; history of science; modern English history; modern European history; state and local history.

The master's program in history is largely individually structured with directed studies, seminars, colloquiums, and tutorials. With a tutorial, the graduate student will audit the lectures of a 300-level course and, in addition, will meet in tutorial sessions with the lecturer to pursue the topic at greater depth. For tutorials, the student may register for HIS 502 or 503 (if the 300-level course deals with European history), HIS 536 or 537 (if the 300-level course deals with American history), or HIS 588 or 589 (if the 300-level course deals with Third World history). These 500-level tutorial courses may be repeated for different 300-level courses in each area, but no more than five of these tutorials will be permitted in the graduate program. Tutorial arrangements must be made with the instructor at the beginning of the semester. For a listing of the 300-level courses, see the *Undergraduate Bulletin.*

Master of Arts

Admission requirements: GRE (advanced test desirable) and bachelor's degree with at least 24 credits in history. Majors in related fields may be admitted with permission of the department.

Program requirements: thesis option—30 credits to include four courses at 500 level, at least two of which must be colloquia; nonthesis option—30 credits to include five courses at the 500 level, at least two of which must be colloquia and one must be a seminar. Both options require an oral examination. The nonthesis option also requires a four-hour written examination. Two courses in a related field are allowed.

Cooperative Program (M.A. and M.L.I.S.)

By proper selection of coursework, a student may earn simultaneously the degrees of Master of Arts in history and Master of Library and Information Studies.

Admission requirements: GRE (advanced test desirable) and other requirements listed for history and library science. Applicant must apply and be accepted in both programs. Applications (in quadruplicate) should indicate History/Library and Information Studies as the field of specialization.

Program requirements: students must submit individual 30-credit (minimum) programs of study for each degree that satisfy specific core requirements for these programs. As a maximum of 6 credits may be jointly used to satisfy degree requirements, a minimum of 54 credits total is required to satisfy the requirements for both degrees.

HIS Courses
History

500 Colloquium in Selected Topics in History *(I or II, 3)* Intensive study of major interpretive works in various thematic, crossnational topics. *(Sem. 3) Pre: graduate or senior standing and permission of instructor.* Staff

502, 503 Special Readings in European History *(I and II, 3 each)* Intensive tutorial work, research, and readings in European history. *Pre: graduate standing, permission of instructor, and concurrent audit of parallel 300-level course. May be repeated.* Staff

505 Seminar in Selected Topics in History *(I or II, 3)* Intensive research on selected thematic, crossnational topics. *(Sem. 3) Pre: graduate or senior standing and permission of instructor.* Staff

536, 537 Special Readings in American History *(I and II, 3 each)* Intensive tutorial work, research, and readings in American history. *Pre: graduate standing, permission of instructor, and concurrent audit of parallel 300-level course. May be repeated.* Staff

544 Colloquium in Worker History
See Labor and Industrial Relations 544.

588, 589 Special Readings in Third World History *(I and II, 3 each)* Intensive tutorial work, research, and readings in Third World history. *Pre: graduate standing and permission of instructor. Concurrent audit of parallel 300-level course required. May be repeated.* Staff

591 Directed Study or Research *(I and II, 3)* Directed readings, research, or study designed to meet the particular needs of individuals or small groups of graduate students. Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Home Economics Education
M.S.

Graduate Faculty

Chairperson: Associate Professor Theodore M. Kellogg, Ph.D., 1971, Florida State University

The home economics program is under review. For further information, please contact the department directly.

Specializations

Innovative practices in methods and teaching techniques; curriculum development with specialization in middle school, secondary, adult, recurrent, consumer, and nutrition education; teacher education and supervision; gerontology.

Master of Science

Admission requirements: bachelor's degree with a concentration in home economics education or a related home economics subject area; GRE with advanced test in education or MAT.

Program requirements: thesis option—30 credits including HED 506, 509, 507 or EDC 582, HED elective, research methods

course, basic knowledge of statistics, four-hour written comprehensive examination, and two-hour oral defense of thesis; non-thesis option—36 credits including HED 506, 509, 507 or EDC 582, HED elective, research methods course, four-hour written comprehensive examination, action research project, and oral presentation of action research project.

Other courses may be chosen in accordance with student's background, interests, and needs. Courses may be selected in an allied field such as adult or extension education or in a subject matter area of home economics.

General Information

This program, leading to the Master of Science degree, allows individuals flexibility in the selection of courses to meet their needs and interests. Personalized plans of study with an emphasis on instruction, curriculum, supervision, and research can be developed around a thesis or action research option.

A student may elect a secondary concentration in an associated home economics area such as textiles and clothing, child development and family relations, nutrition, consumer affairs, gerontology, education, or adult education.

The home economics education program also offers courses to meet the Rhode Island certification requirements for a permanent teaching certificate.

HED Courses
Home Economics Education

478, 479 Problems in Home Economics Education *(I and II, 1–3 each)*

491 Teaching Home Economics: Adults *(II, 3)*

506 Instructional Communications *(I or II, 3)* Selection, organization, and use of instructional materials, methods, and techniques for effective home economics teaching in a formal or informal educational setting. *(Lec. 3) In alternate years.* Staff

507 Curriculum Development *(I or II, 3)* New developments in curriculum planning as related to organization and administration of comprehensive and occupational home economics and other vocational programs; evaluation as it relates to an effective program. *(Lec. 3) Pre: one year of teaching experience or permission of chairperson. In alternate years.* Staff

508 Supervision of Student Teachers *(I or II, 3)* For teachers desiring to supervise students preparing for provisional certificates in agriculture, business, distributive education, or home economics. Meets requirements for a Critic Teacher Certificate in the areas listed. *(Lec. 3) Pre: at least one year of teaching experience and permission of chairperson. In alternate years.* Staff

509 Seminar in Home Economics Education *(I or II, 3)* Study of current trends and issues as they affect home economics education; critical study of research literature and techniques appropriate to solution of problems. *(Lec. 3) In alternate years.* Staff

586, 587 Problems in Home Economics Education *(I and II, 3 each)* Advanced work for graduate students in home economics education. Conducted as seminars or as supervised individual projects. *(Lec. or Lab.) Pre: permission of chairperson.* Staff

595 Master's Project: Action Research *(I and II, 1–6)* Candidates plan and carry out an action research project approved by the instructor. Number of credits is determined each semester in consultation with the major professor. *Pre: admission to a master's program in home economics education, a course in research methods, and permission of chairperson. May be repeated for a maximum of 6 credits.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

CNS Courses
Consumer Studies

401 Consumer and Managerial Problems of Families with Special Needs *(I or II, 3)*

420 Consumer Protection *(I or II, 3)*

422 Consumer Issues Research *(I or II, 3)*

457 (or HLT 457) Health and Safety Issues of Consumer Products *(I or II, 3)*

470 Special Problems *(I and II, 2–4)*

570 Special Problems *(I or II, 3)* Advanced study to be selected from areas of home management theory and its application, work simplification, family economics, and equipment. *(Lab. TBA)* Staff

Human Development, Counseling, and Family Studies
M.S.

Graduate Faculty

Chairperson: Professor Stewart Cohen, Ph.D., 1967, Purdue University

Human Development and Family Studies
Coordinator: Professor Stewart Cohen, Ph.D., 1967, Purdue University
Professor Gwenneth Rae, Ed.D., 1972, University of California
Associate Professor Phillip G. Clark, 1979, Sc.D., Harvard University
Assistant Professor Joan Gray Anderson, Ph.D., 1984, University of California
Assistant Professor Diane Horm-Wingerd, Ph.D., 1985, Virginia Polytechnic Institute
Assistant Professor Karen A. Schroeder, Ph.D., 1977, University of Connecticut
Professor Emeritus George T. Fitzelle, Ph.D., 1952, Cornell University
Professor Emerita Mollie S. Smart, Ph.D., 1970, University of Delhi
Professor Emeritus Russell C. Smart, Ph.D., 1938, University of Minnesota
Professor Emeritus Donald L. Spence, Ph.D., 1965, University of Oregon
Associate Professor Emerita Helen F. Greene, Ph.D., 1954, Florida State University

Marriage and Family Therapy
Coordinator: Professor Peter E. Maynard, Ph.D., 1969, State University of New York, Buffalo
Professor Gwenneth Rae, Ed.D., 1972, University of California
Associate Professor Thomas J. Gunning, Ed.D., 1966, Boston University
Associate Professor Jerome A. Schaffran, Ph.D., 1971, University of Iowa
Assistant Professor Karen A. Schroeder, Ph.D., 1977, University of Connecticut
Professor Emeritus George T. Fitzelle, Ph.D., 1952, Cornell University
Associate Professor Emeritus Alfred C. Pascale, Ed.D., 1958, Boston University

Counseling
Coordinator: Associate Professor Thomas J. Gunning, Ed.D., 1966, Boston University
Professor Peter E. Maynard, Ph.D., 1969, State University of New York, Buffalo
Associate Professor Jerome A. Schaffran, Ph.D., 1971, University of Iowa
Assistant Professor Jayne Richmond, Ph.D., 1982, University of Florida
Associate Professor Emeritus Alfred C. Pascale, Ed.D., 1958, Boston University

College Student Personnel
Coordinator: Associate Professor Jerome A. Schaffran, Ph.D., 1971, University of Iowa
Assistant Professor Jayne Richmond, Ph.D., 1982, University of Florida
Professor Peter E. Maynard, Ph.D., 1969, State University of New York, Buffalo
Associate Professor Thomas J. Gunning, Ed.D., 1966, Boston University

Specializations

Human development and family studies; marriage and family therapy; counseling; college student personnel.

Human Development and Family Studies

Admission requirements: GRE or MAT and 18 undergraduate credits distributed among at least three of the following areas: human development and family studies, psychology, sociology, biology, and education. Subspecializations are available in human development, early childhood education, family studies, and gerontology.

Program requirements: 24 credits plus 6 credits toward thesis or 6 related action research credits (30 credits total minimum) and comprehensive examination.

State Provisional Certification: persons wishing to meet state provisional certifica-

tion requirements (Nursery to Grade 2) must apply for admission to teacher certification (nondegree status). Official transcripts of all previous coursework plus two letters of recommendation are required. As a prerequisite to enrolling in courses which meet certification requirements, accepted applicants must complete or have completed the equivalent of an undergraduate degree in human development, counseling, and family studies.

Marriage and Family Therapy

Admission requirements: GRE or MAT and at least 15 credits in family relations, developmental theory, personality theory, or family sociology; at least two of the three letters of recommendation attesting to observed experience in a related field and to emotional stability and maturity; and a personal interview. Selection for admission to this specialization is highly competitive, and enrollment is limited. The program adheres to the standards established by the American Association for Marriage and Family Therapy (AAMFT).

Program requirements: a minimum of 45 credits of approved graduate courses, including a 30-hour core and 15 credits of approved electives depending on previous training and background, and a comprehensive examination. This program involves intense clinical practice and a year-long internship at cooperating agencies or the department's Family Therapy Clinic; therefore, full-time students are preferred. Deadline for admission is April 1.

Counseling: Elementary and Secondary, Gerontological, and Mental Health

Admission requirements: GRE or MAT, minimum of 12 credits in the behavioral sciences (to include a background in developmental theory, personality theory, and abnormal psychology), and a personal interview. The school counseling subspecialization is approved by and adheres to the standards established by the National Association of State Directors of Teacher Education and Certification (NASDTEC). Teacher certification is required for school counseling.

Program requirements: thesis or nonthesis option. Minimum 45-credit program. HCF 450, 551, 554, 560, 562, graduate research course, such as EDC 529, HCF 570, PSC 505, and either thesis (HCF 599, 6 credits) or internship (HCF 583, 584, 6 credits with concurrent enrollment in HCF 580, 581, 6 credits). Additional courses planned with advisor according to subspecialization. The total number of credits required may vary according to the professional experience of the individual or the requirements of various certifying bodies. Subspecializations include: mental health counseling—HCF 535, 553, alcohol and family coursework; gerontological counseling—HCF 553, 555, 520, family coursework; school counseling—HCF 550, 553, family coursework.

College Student Personnel

Admission requirements: GRE or MAT and interview; preference given to applicants with experience in student affairs.

Program requirements: 27 credits in core HCF courses (HCF 450, 551, 554, 560, 562, 567, 568, 570, 590), 6 credits in adult development and social science electives, plus one of the following—a) nonthesis option with internship (HCF 580, 581, 583, 584, and a comprehensive examination); b) nonthesis option with action research project (HCF 595, 6 credits, one additional elective, and a comprehensive examination); or c) thesis option (HCF 599, 6 credits, and one additional elective).

HCF Courses
Human Development, Counseling, and Family Studies

400 Child Development: Advanced Course *(I and II, 3)*
406 Growth and Development during Infancy *(I, 3)*
420 Human Development during Adulthood *(I and II, 3)*
421 Death, Dying, and Bereavement *(II, 3)*
422 Aging: Case Coordination *(II, 3)*
424 Design and Delivery of Services for Mentally Retarded Adults *(II, 3)*
430 Family Interaction *(I and II, 3)*
431 Family and the Elderly *(II, 3)*
432 Perspectives on Parenting *(II, 3)*
433 Family Life Education *(II, 3)*
434 Children and Families in Poverty *(II, 3)*
435 Developmental Assessment in Early Childhood *(SS, 6)*
437 (or SOC 437) Law and Families in the United States *(I or II, 3)*
440 Environmental Context of Aging *(I or II, 3)*
450 Introduction to Counseling *(I and II, 3)*
497, 498 Special Problems *(I and II, 1–3 each)*

500 Child Development Seminar *(I or II, 3)* Intensive study of selected topics, such as development of cognitive processes, individual and group differences in development of language, hereditary factors in physical growth. Review papers by students presented to class. *(Lec. 3) Pre: 400 or permission of chairperson.* Staff

501 Seminar in Early Childhood Education *(I or II, 3)* Seminar in trends and model programs in early childhood education. Special attention to substantive evaluation and program design issues for the professional early childhood educator. *(Lec. 3) Pre: student teaching or equivalent classroom experience or permission of instructor.* Staff

502 Cognitive Aspects of Early Childhood *(I or II, 3)* Impact of theory and research in cognitive development and its relation to language, learning, and thinking. Special attention to Piaget's impact on current research and educational programs. *(Lec. 3) Pre: 200, 201, or permission of instructor.* Staff

504 Contemporary Theories of Ego Development *(I, 3)* Surveys of the recent theoretical constructs which synthesize the cognitive and psychosocial traditions into a developmental view of the ego. The relevance of the psychology of women to this synthesis is also considered. *(Sem. 3) Pre: graduate standing and permission of instructor. In alternate years.* Staff

505 Theories and Issues in Human Sexuality *(II, 3)* Interdisciplinary inquiry into the significance of sexuality in human experience. Historical, cultural, and developmental issues in human sexuality. Implications for self understanding. *(Lec. 3) Pre: permission of instructor.* Staff

520 Developmental Issues in Later Life *(I or II, 3)* Theoretical and philosophical foundations for understanding the normal changes, pathological developments, clinical assessments, and intervention strategies associated with later life. *(Sem. 3) Pre: graduate standing.* Staff

527 Health Care Policy and the Elderly *(II, 3)* Present and future problems in policy development to meet health care needs of the elderly. Consideration of historical aspects, demographic change, policy models. *(Sem. 3) Pre: graduate standing.* Staff

529 Practicum Seminar in Gerontology *(I and II, 1)* A seminar focusing on adult development and aging. Designed for graduate students in gerontology to exchange results of original research or practical experiences through reports and discussions. *Pre: graduate standing or permission of instructor. May be repeated for a maxmum of 3 credits.* Staff

530 Family Theory Seminar *(I, 3)* Intensive study of theories in the family field, integrated with contemporary family issues, and family therapy. *(Lec. 3) Pre: 430 or permission of instructor.* Staff

535 Families under Stress: Coping and Adaptation *(I, 3)* Theoretical models of family interaction, development, and stress as applied to understanding of family behavior in managing stress or events. Concepts of stress, vulnerability, adaptability, coping, regenerative power, social supports, and related research. *(Lec. 3) Pre: 430, 570, or equivalent graduate coursework in family development or family sociology and permission of instructor.* Staff

550 Vocational Information and Career Development *(I or II, 3)* Classification and description of jobs and industries; study of occupational trends; needs of special groups entering the labor market; vocational development theories and counseling for long-range career planning. *(Lec. 3) Pre: 450 and graduate standing.* Staff

551 Counseling Theory and Techniques *(I and II, 3)* Theoretical foundation and practice of counseling and therapy in various settings. *(Lec. 3) Pre: graduate standing.* Staff

553 Counseling Practicum *(I and II, 3)* Advanced counseling and therapy issues. Multiple sessions using tapes and critiques to assess growth and competence of the clinician. Limited enrollment. *(Lec. 1, Lab. 5) Pre: 450, 551, advanced standing, and permission of instructor.* Staff

554 Individual Appraisal in Human Services *(II, 3)* Nature of the appraisal process and data essential to understanding the educational, vocational, and social needs of persons. Emphasis is on a team approach to counseling services and the utilization of case materials. *(Lec. 3) Pre: 551 and 570.* Staff

555 Gerontological Counseling *(I or II, 3)* An overview of the developmental process of later life, particularly relevant to counselors and therapists. Clinical counseling implications and therapeutic strategies will be emphasized. *(Lec. 3) Pre: 420, 450, or equivalent, and graduate standing. In alternate years.* Staff

559 Women and Therapy *(I or II, 3)* Techniques for helping counselors and clients, male and female, deal with issues and needs growing out of society's changing views about women. Emphasis on research therapist self-awareness, and evaluation of current therapies. *(Lec. 3) Pre: 450, 551, and permission of instructor.* Staff

560 Group Procedures in Counseling *(I and II, 3)* Principles and techniques of group counseling and therapy as applied to education, counseling, and student personnel work. A practical and theoretical approach with emphasis on facilitation techniques, leadership patterns, and counseling skills. Enrollment is limited. *(Lec. 3) Pre: 551 and permission of instructor.* Staff

562 Organization Development in Human Services *(II, 3)* Theory and technology of organization development as applied in human service agencies; entry diagnosis, implementation, and evaluation strategies, skills practice in consulting and training; evaluation and research of change efforts. *(Lec. 2, Lab. 4) Pre: 560.* Staff

563 Marital and Family Therapy I *(I, 3)* Major theoretical perspectives, including system theory as related to therapy. Communication and relationship skills, negotiation and behavioral contracting, treating specific relationship problems, therapy evaluation. *(Sem. 3) Pre: 430 and permission of instructor.* Staff

564 Marital and Family Therapy II *(II, 3)* Major contemporary theories of family therapy and the development of family therapy as a unique intervention strategy; special consideration of issues and problems commonly confronted in conducting family therapy. *(Lec. 3) Pre: 563.* Maynard

565 Family Therapy Practicum *(I or II, 3)* Supervised clinical experience in marriage and family therapy. Case materials will be presented by students, and taped segment of actual counseling sessions will be reviewed. *(Lec. 1, Lab. 5) Pre: 563, 564, and permission of instructor.* Staff

566 Theoretical and Clinical Problems *(II, 3)* Examination of major ongoing and emerging theoretical issues in family therapy. The implications of these problems in clinical practice with families. *(Lec. 3) Pre: 564 and graduate standing.* Staff

567 Principles and Practices of Student Personnel Services in Higher Education *(I, 3)* Survey of the historical, psychological, organizational, and educational factors which have evolved and combined to form student personnel work. *(Lec. 3) Pre: graduate standing and permission of instructor. In alternate years.* Staff

568 Organization and Administration of Student Personnel Services in Higher Education *(II, 3)* Systematic analysis of current practices in the alignment and operation of student personnel services, with continuing review of their interrelationships with the total educational program. *(Lec. 3) Pre: 567. In alternate years.* Staff

570 Research in Human Development and Family Studies *(I and II, 3)* Historical, philosophical, and procedural foundations of scientific inquiries into individuals and families. Explores the various ways to acquire information about human development and family relationships. *(Lec. 3) Pre: graduate standing or permission of instructor.* Staff

580, 581 Professional Seminar in Counseling *(I and II, 3 each)* A two-semester sequence examining legal, ethical, and professional issues and standards related to counseling and therapy. Analysis of problems encountered in the internship experience. *(Lec. 3) Pre: concurrent enrollment in 583, 584, advanced standing, and permission of instructor.* Staff

582 Field Experience in Human Development and Family Studies *(I or II, 3)* Interdisciplinary seminar and laboratory with observation and supervised projects in field settings. *(Lec. 1, Lab. 4) Pre: permission of instructor.* Staff

583, 584 Master's Internship *(I and II, 3 or 6 each)* Supervised field practice in mental health or family agencies, schools, or colleges to integrate counseling and therapy theories and skills. *Pre: concurrent enrollment in 580 for 583, 581 for 584.* Staff

590 Higher Education Law *(I or II, 3)* An overview of federal and state legal systems' effect on university administration and service delivery. Reviews authorities and agencies, major court decisions, and the application of substantive and procedural law principles. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Staff

595 Master's Project: Action Research *(I and II, 1–6)* Number of credits is determined each semester in consultation with the major professor. Minimum of 6 credits is required of students who have chosen the action-thesis option. *S/U credit.*

597, 598 Advanced Study *(I and II, 1–3 each)* Survey of important research contributions significant to the understanding of human development and relationships. *(Lec. 1–3)* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. The minimum of 6 credits is required of students who have chosen the thesis option. *S/U credit.*

HSS Courses
Human Science and Services

491, 492 Special Problems *(I or II, 1–3 each)*

530 Multidisciplinary Health Seminars for the Elderly *(I or II, 3)* Field experience for students in various health disciplines. Development of assessment techniques, curricular materials, and team delivery of health seminars to the elderly at community sites. *(Sem. 3) Pre: graduate standing or permission of instructor.* Clark and Staff

Industrial Engineering

See Manufacturing Engineering on page 63.

International Studies

International studies are represented by international orientations in many graduate programs as well as by the specialized programs described here. Inquiries concerning international orientations available through the various combinations of electives within existing degree programs may be addressed to the department in which the student plans to enroll or to the dean of the Graduate School. Further information may also be obtained from Donald McCreight, chairperson, International Studies Committee; Diedre Badejo, director of African and Afro-American Studies; Norman Coates, coordinator, international management specialization in the MBA program; and Josephine Milburn, coordinator, international development specialization.

Specializations

Master of Arts in Political Science with International Relations Specialization. The Department of Political Science offers courses in international relations and area studies enabling students to fashion programs suitable to their special interests. To ensure an interdisciplinary approach, the department encourages students to take up

to 12 credits of relevant course offerings in economics, history, marine affairs, or sociology. For requirements, see Political Science.

Master's Degree with International Development Specialization: The graduate programs in economics, labor and industrial relations, marine affairs, political science, resource economics, and sociology offer master's degree candidates a specialization in international development. Students electing this specialization must fulfill the requirements of the appropriate master's program and are required to take REN 595 International Development Core Seminar and 6 credits of related electives.

Graduate Certificate Program in International Development Studies. A five-course, 15-credit program leading to a graduate certificate awarded by the dean of the Graduate School is offered in each spring semester by the Departments of Economics, Marine Affairs, Political Science, and Resource Economics. African and Afro-American Studies and the Department of Sociology and Anthropology also participate in certain aspects of this program, which is designed to provide a supplemental, interdisciplinary specialization concentrating on the problems and processes of modernization and international development.

Admission requirements: GRE and master's degree or equivalent, or concurrent enrollment in a master's program in one of the participating fields.

Program requirements: interdisciplinary core seminar (REN 595—Problems of Modernization in Developing Countries); two specialized seminars selected from PSC 510, ECN 566, REN 430; 3 credits of directed study selected from PSC 556, ECN 515, 516, REN 491, 492, or MAF 591, 592; and 3 credits of approved elective. When the graduate certificate is pursued concurrently with a master's degree, the certificate credit requirements must be taken in addition to all requirements for the master's degree. Completion of the master's degree program is required to receive the certificate.

Requests for further information and for application forms should be directed to the dean of the Graduate School. Initial inquiries should indicate in which of the above disciplines and from which institution the applicant holds the master's degree, or whether he or she is interested in pursuing the master's degree at this University concurrently with the graduate certificate program, and where his or her particular research interests lie. Such information will assist the administering committee in selecting an advisor for the student and in designing a program adapted to his or her needs. Assistantships or scholarships are not available for participants in the graduate certificate program as such, but may be held by students who are concurrently enrolled in one of the participating master's programs.

Labor and Industrial Relations
M.S.

Graduate Faculty

Director, Labor Research Center: Professor Charles T. Schmidt, Jr., Ph.D., 1968, Michigan State University (Professor of Industrial Relations)
Professor Judith Anderson, Ph.D., 1970, Indiana University
Professor Charles P. Armstrong, Ph.D., 1973, University of Arizona
Professor Harold Barnett, Ph.D., 1973, Massachusetts Institute of Technology
Professor Winifred E. Brownell, Ph.D., 1973, State University of New York, Buffalo
Professor Norman Coates, Ph.D., 1967, Cornell University
Professor William Croasdale, Ed.D., 1966, Teacher's College, Columbia University
Professor Albert J. Della Bitta, Ph.D., 1971, University of Massachusetts
Professor James F. Findlay, Jr., Ph.D., 1961, Northwestern University
Professor Carl Gersuny, Ph.D., 1968, Western Reserve University
Professor Timothy M. Hennessey, Ph.D., 1968, University of North Carolina
Professor Jeffrey E. Jarrett, Ph.D., 1967, New York University
Professor Bernice Lott, Ph.D., 1954, University of California, Los Angeles
Professor Josephine F. Milburn, Ph.D., 1956, Duke University
Professor Craig E. Overton, Ph.D., 1971, University of Massachusetts
Professor John J. Poggie, Jr., Ph.D., 1968, University of Minnesota
Professor Elton Rayack, Ph.D., 1957, University of Chicago
Professor Lawrence Rothstein, Ph.D., 1976, University of Massachusetts
Professor Richard W. Scholl, Ph.D., 1980, University of California, Irvine
Professor Sharon H. Strom, Ph.D., 1969, Cornell University
Professor Robert Weisbord, Ph.D., 1966, New York University Graduate School
Professor Stephen B. Wood, Ph.D., 1964, University of Chicago
Associate Professor Emily Andrews, Ph.D., 1976, University of Pennsylvania
Associate Professor John P. Burkett, Ph.D., 1981, University of California, Berkeley
Associate Professor Jerry Cohen, Ph.D., 1973, University of Illinois
Associate Professor Leonard P. Lardaro, Ph.D., 1979, Indiana University
Associate Professor Andrew Laviano, J.D., 1982, New York University School of Law
Associate Professor Blair M. Lord, Ph.D., 1975, University of California
Associate Professor Arthur C. Mead, Ph.D., 1978, Boston College
Associate Professor Yngve Ramstad, Ph.D., 1981, University of California, Berkeley
Associate Professor Beatrice Schultz, Ph.D., 1969, University of Michigan
Associate Professor James L. Starkey, Ph.D., 1971, Boston College
Assistant Professor Laura Beauvais, Ph.D., 1987, University of Tennessee, Knoxville
Assistant Professor Anne Christner, Ph.D., 1980, The University of Rhode Island
Assistant Professor Elizabeth Cooper, Ph.D., 1985, University of Akron
Assistant Professor Diane Disney, Ph.D., 1989, Brandeis University
Assistant Professor Mark Grossman, J.D., 1968, Brooklyn Law School
Assistant Professor C.N. Hetzner, Ph.D., 1985, University of Massachusetts, Amherst
Assistant Professor Sandra Ketrow, Ph.D., 1982, Indiana University
Assistant Professor Charles Latos, Ph.D., 1977, Brown University
Assistant Professor Carole Miller, Ph.D., 1983, Syracuse University
Assistant Professor Scott Molloy, M.A., 1972, University of New Hampshire
Assistant Professor Teresa Murphy, Ph.D., 1982, Yale University
Assistant Professor Gail A. Shea, Ph.D., 1975, Brown University
Adjunct Professor Michael J. Keating, J.D., 1973, Georgetown University Law School
Adjunct Professor Suzanne Taylor, Ph.D., 1970, University of Connecticut

The program is designed for union, government, neutral, or human resource management labor and industrial relations professionals, or for those students who aspire to such positions. Students in other graduate programs may find it rewarding and professionally desirable to enroll in one or more of the labor relations and labor studies courses. All courses are offered in the very late afternoon or evening hours in Providence and in Kingston so that they are convenient for those currently employed. Full-time or part-time programs are available.

Master of Science

Admission requirements: GRE or MAT or GMAT. Undergraduate majors in any field will be considered for admission. Those with social science, history, management, and labor studies majors are especially encouraged to apply, as are those with engineering, nursing, education, urban affairs, black studies, and women's studies backgrounds. Professional experience in labor and industrial relations will carry additional weight in admission decisions.

Program requirements: minimum of 36 credits including 27–28 credits in core courses and 9 credits of specialization plus requirements of 3 credits each in statistics and computer science which may be met by prior coursework or examination, and a written master's examination. The required core courses (27–28 credits) are: LRS/HIS 544; LRS/PSC 521; LRS/SOC 432 or MGT 630; LRS/ECN 526 and 534; LRS 531, 541, 542, and 580.

The areas of specialization are listed here together with available courses. Substitutions may be made with permission of the director of the Labor Research Center and approval of the Graduate School.

Labor relations: 3 courses from LRS 520, 533, 545, 581, 590, 591; MGT 640; and LRS 543 or 579.

Human resource administration: 3 courses from MGT 640; PSC 503 or MGT 641; LRS 533, 545, 581, 590, 591 and LRS 543 or 579; PSY 434; EDC 529 or 583; and CPL 535 or 543.

Labor and worker studies: 3 courses from LRS 520, 545, 581, 590, 591; ENG 445; HIS 591; PSC 486; and PSY 480.

Worker/labor or management education and training: 3 courses from LRS/EDC 579; LRS 581; LRS 590, 591; EDC 505, 539, 581, 582, 583, 584.

International development: 3 courses including REN 595 and two related electives as described under International Studies (see page 58).

Alternative dispute and conflict resolution processes: 3 courses including LRS 545, 546, 581, 590, 591, and PSC 420 or 432.

Nondesignated specialization: 3 courses in an area which satisfies the student's individual professional goals, e.g., computer science or statistics; economics or social policy; law and legal processes; or workplace issues such as alcohol and drug abuse; sexual or age discrimination, or racism.

LRS Courses
Labor and Industrial Relations

432 Industrial Sociology *(I or II, 3)*

520 Labor Union Government and Structure *(I or II, 3)* Structure, functions, responsibilities, and programs of unions and union leadership. Emphasis on policies and decision making. Evaluation of labor and management performance. Consideration of administrative problems associated with growth of white collar unions. *(Lec. 3) Pre: credit or concurrent enrollment in 544.* Molloy

521 (or PSC 521) International and Comparative Trade Unions and Labor Relations *(I or II, 3)* Comparative labor and industrial relations systems, including union, management, and government functions and roles; also the functions of international organizations in labor relations. *(Lec. 3) Pre: 544 or permission of LRC director.* Rothstein or Schmidt

526 (or ECN 526) Economics of Labor Markets *(I, 3)* The theory of labor market behavior, and application of theory for public policy analysis in areas such as discrimination, unemployment, and education.*Pre: ECN 125 and 126 or 590 or equivalent.* Rayack, Miller, or Andrews

531 Employment Law *(I or II, 3)* Analysis of legislation protecting worker health, employment, income security, including OSHA, workers' compensation, equal opportunity, fair labor standards, Walsh-Healy and Davis-Bacon, pension funds, unemployment compensation, and social security. *(Lec. 3) Pre: permission of chairperson.* Tabor

533 Negotiating Pension, Health, and Employee Assistance Programs *(I, II, or SS, 3)* An analysis of employee assistance plans (EAPs), health fringe benefits, and pension plans and their negotiation within both the private and public sectors. *(Lec. 3) Pre: permission of instructor and LRC director.* Staff

534 (or ECN 534) Information Sources and Uses in Labor Relations and Labor Economics *(II, 3)* Analysis and use of data and information sources specific to the professional fields of labor and industrial relations and labor economics. A major project utilizing personal computer software is required. *(Lec. 3) Pre: 526 and MGS 500 and 530 or permission of instructor. Not for graduate credit for M.B.A. or M.S. in accounting students.* Lardaro or Andrews

541 Labor Relations Law *(I or II, 3)* Legal framework for private and public sector collective bargaining. Regulation of activities with emphasis on individual rights, collective rights, and policy considerations of federal and state courts, the NLRB, and state labor boards in determining society's rights. Case studies. *(Lec. 3) Pre: 544 or permission of instructor.* Grossman

542 Labor Relations and Collective Bargaining *(I or II, 3)* Collective bargaining literature, theories, and practice. Bargaining approaches, techniques, and dynamics will be stressed through the analysis of comprehensive case studies. *(Lec. 2, Lab. 2) Pre: 541 and 544 or permission of LRC director.* Schmidt

543 Labor Relations and Collective Bargaining: Public Sector *(I or II, 3)* Public sector (state, municipal, federal, police, fire, K–12 education, and higher education) collective bargaining theory, practice, and legal foundations. Comprehensive case studies. *(Lec. 2, Lab. 2) Pre: credit or concurrent enrollment in 542 or permission of LRC director.* Staff

544 (or HIS 544) Colloquium in Worker History *(I or II, 3)* Selected topics in American worker history with an emphasis on the most recent literature in the field. *(Sem. 3) Pre: graduate standing or permission of instructor.* Molloy

545 Labor Dispute Settlement *(II, 3)* Reading, procedures, and cases in the settlement of labor disputes in both private and public sectors. Emphasis on arbitration, mediation, and fact-finding. *(Lec. 3) Pre: 541 and 542 or permission of LRC director.* Staff

546 Alternative Dispute Resolution Processes and Applications *(I, II, or SS, 3)* Examination of mediation, fact-finding, arbitration, and other conflict resolution processes as alternatives to litigation in a variety of dispute situations, e.g., community, environmental, divorce, landlord-tenant, prison, racial, commercial. *(Lec. 3) Pre: permission of instructor.* Staff

579 (or EDC 579) Labor Relations and Collective Bargaining in Education *(I, II, or SS, 3)* Collective bargaining in public and private educational sectors, K–12, higher education; literature, theory, practice, and legal foundations in education. Comprehensive case studies will be used. *(Lec. 3)* Croasdale

580 Professional Seminar: Labor and Industrial Relations *(II, 3)* Advanced labor relations seminar of variable coverage and focus; adjusted yearly to consider most recent labor relations developments. Major research paper required. *(Sem. 3) Pre: final semester graduate standing in labor and industrial relations and permission of LRC director.* Staff

581 Internship: Labor and Industrial Relations *(I and II, 3–6)* Variable length internship with a trade union, a public or private sector personnel or industrial relations department, or a governmental administrative or regulatory agency, under the supervision of both an LRC faculty member and a member of the affiliated organization. May be taken as one 6-credit unit or two 3-credit units. *Pre: graduate standing in labor and industrial relations and permission of LRC director.* Schmidt

590, 591 Directed Readings and Research in Labor and Industrial Relations *(I and II, 3 each)* Readings and research under the direction of LRC-associated faculty to meet individual student requirements. *Pre: graduate standing in labor and industrial relations and permission of the director of the Labor Research Center and the instructor.* Staff

Languages

The University offers Master of Arts degrees in comparative literature studies, French, and Spanish.

Comparative Literature Studies
M.A.

See Comparative Literature Studies on page 40.

French
M.A.

See French on page 52.

Spanish
M.A.

See Spanish on page 97.

GER Courses
German

409 History of the German Language *(I, 3)*
421 Business German *(I, 3)*
441, 442 German Literature of the Eighteenth Century *(I and II, 3 each)*
451, 452 German Literature of the Nineteenth Century *(I and II, 3 each)*
485, 486 Special Studies *(I and II, 3 each)*
497 Directed Study *(I and II, 1–3)*
498 Directed Study *(I and II, 3)*

586 Seminar in German Studies *(I, II, and SS, 3)* Topics in German literature and civilization. *Pre: graduate standing or permission of instructor. May be repeated with different topics.* Staff

598 Directed Studies *(I, II, and SS, 1–3)* Individual research on problems of special interest. *Pre: graduate standing, acceptance of project by a staff member, and permission of the chairperson. May be repeated with different topics.* Staff

987, 988 German Play Production *(SS, 1 each)* Study and production of a German play or plays. *Pre: 215 and 216 or equivalent. Students may enroll concurrently in 485, 486.* Staff

GRK Courses
Greek

497, 498 Directed Study *(I and II, 3 each)*

ITL Courses
Italian

408 The Italian Language *(I or II, 3)*
455 Selected Italian Authors *(I or II, 3)*
465 Topics in Italian Literature *(I or II, 3)*
480 Business Italian *(I or II, 3)*
481, 482 The Works of Dante Alighieri *(I and II, 3 each)*
497, 498 Directed Study *(I and II, 3 each)*

LAT Courses
Latin

497, 498 Directed Study *(I and II, 3 each)*

LIN Courses
Linguistics

431 Applied Linguistics in the Language Laboratory *(I, 1)*
497, 498 Directed Study *(I and II, 3 each)*

The following are related, specialized courses in historical linguistics offered in the Departments of English and Languages.

ENG 530 History of the English Language
FRN 503 History of the French Language
GER 409 History of the German Language
ITL 409, 410 History of the Italian Language

RUS Courses
Russian

460, 461 The Russian Novel *(I and II, 3 each)*
497, 498 Directed Study *(I and II, 3 each)*

Library and Information Studies
M.L.I.S.

Graduate Faculty

Director, Graduate School of Library and Information Studies: Professor Elizabeth Futas, Ph.D., 1980, Rutgers—The State University
Assistant to the Director for Regional Studies: Assistant Professor Patricia E. Jensen, Ph.D., 1983, University of Connecticut
Associate Professor Stewart P. Schneider, Certificate in Advanced Librarianship, 1974, Columbia University
Associate Professor Jonathan S. Tryon, Certificate in Advanced Librarianship, 1974, Columbia University; J.D., 1981, Suffolk University
Associate Professor Fay Zipkowitz, D.A., 1977, Simmons College
Assistant Professor C. Herbert Carson, Ph.D., 1987, Syracuse University
Assistant Professor Leena Siitonen, Ph.D., 1984, University of Pittsburgh

Specializations

The overall goal of the school is to educate librarians who will not only function effectively, but also demonstrate the capacity to affect the course of librarianship. The Graduate School of Library and Information Studies prepares students for professional service in libraries and information agencies by offering an ALA-accredited program leading to the Master of Library and Information Studies (M.L.I.S.) degree. It also provides an opportunity for students to pursue simultaneously master's degrees in library and information studies and in history or public administration. The school library media specialization is accredited by NASDTEC.

Through consultation with advisors, students prepare for careers in academic, school, public, or special libraries. They also may plan for specialization in areas such as children's service, reference and bibliography, cataloging, special collections, media programs, information science, automation, administration, young adult services, and library history.

Master of Library and Information Studies

Admission requirements: GRE with combined verbal and quantitative score of 1000 or above or MAT at the 50th percentile or better and a bachelor's degree (B average). All materials required for application should be received by the Graduate School by November 15 for spring admission, February 15 for summer admission, and April 15 for fall admission. Notification of acceptance or denial is mailed approximately six weeks after receipt by the Graduate School.

Program requirements: 36 credits consisting of LSC 501, 502, 503, 504, and 505; 21 credits of electives of which up to 9 may be taken in courses outside library science when relevant to the student's specialization; one course with major paper requiring significant independent research; a written comprehensive examination. Up to 21 hours may be taken at the regional centers at University of Massachusetts in Amherst or Boston and at the University of New Hampshire at Durham.

Diploma in Advanced Librarianship

Admissions to the D.A.L. program have been suspended, and no applications are being accepted. For further information, please contact the department directly.

Cooperative Program (M.A. in History and M.L.I.S.)

By proper selection of coursework, a student may earn simultaneously the degrees of Master of Arts in history and Master of Library and Information Studies.

Admission requirements: GRE (subject test desirable) and other requirements listed for history and library science. Applicant must apply and be accepted in both programs. Applications (in quadruplicate) should indicate history/library and information studies as the field of specialization.

Program requirements: student must submit individual 30-credit (minimum) programs of study that satisfy specific core requirements for each degree. Since a maximum of 6 credits may be jointly used to satisfy degree requirements, a minimum of 54 credits total is required to satisfy the requirements for both degrees.

Cooperative Program (M.P.A. and M.L.I.S.)

A second cooperative program permits joint enrollment in the Master of Library and Information Studies and Master of Public Administration programs, each of which requires a minimum of 36 credits when taken separately. The integrated pursuit of the two degrees makes it possible for 9 credits of appropriately selected coursework from one program to serve as electives in the other, and for 6 credits to be applied in the opposite direction. Thus, when planned and taken jointly, the two programs can be completed with a total of 57 credits.

Admission requirements: GRE and other requirements listed for M.L.I.S. and M.P.A. Applicant must apply and be accepted in both programs. Applications (in quadruplicate) must indicate M.L.I.S./M.P.A. as the field of specialization.

Program requirements: each student must complete the required core courses for both programs plus 3 credits of PSC 590 for the M.P.A. Students must file separate programs of study for each degree, indicating the courses to be jointly counted. Each student must pass the separate comprehensive examination for each degree. A student who fails to complete one of the programs may, of course, complete the other in accordance with the separate program of study.

LSC Courses
Library and Information Studies

501 Foundations of Library and Information Science *(I and II, 3)* Overview of the field covering the language and literature of librarianship; the history and functions of libraries; the nature of various types of libraries, the profession, operations, and new technologies. *(Lec. 3) Pre: graduate standing or permission of instructor.* Tryon, Zipkowitz, and Carson

502 Library Administration *(I and II, 3)* The scientific analysis of library administration ranging from the community survey and formulation of goals and objectives to case studies on public and technical services, staffing and personnel, and buildings. *(Lec. 3)* Siitonen and Zipkowitz

503 Collection Development *(I and II, 3)* Introduction to process, practices, and problems of collection building, maintenance, and evaluation regardless of format or subject of material, type of institutional setting, or community or client group served. *(Lec. 3)* Futas and Tryon

504 Reference and Information Services *(I and II, 3)* Practical experience in the use of basic information sources with readings and discussion on the philosophy and administrative aspects of reference work. *(Lec. 3)* Schneider and Futas

505 Organization of Library Materials *(I and II, 3)* Introduction to the principles and practice of descriptive and subject cataloging and classification systems with an introduction to Library of Congress classification. Includes OCLC searching and tagging. *(Lec. 3)* Zipkowitz

506 Technical Services *(I or II, 3)* Principles and policies in the acquisition, organization, conservation, and circulation of materials in libraries and information centers. Includes examination of automation of library processes. *(Lec. 3) Pre: 501.* Zipkowitz

510 History of Books and Printing *(I or II, 3)* The art and craft of book production through the ages; printers, methods, and materials with consideration given to the role of the book in cultural development. *(Lec. 3)* Tryon

511 Comparative Librarianship *(I or II, 3)* The comparative analysis of librarianship in selected countries in various regions of the world, including the social, cultural, economic, and political factors, and the study of the role of international organizations in library and information science. *(Lec. 3)* Siitonen

512 History of Libraries and Librarianship *(I or II, 3)* The development of libraries and librarianship within a cultural, social, and economic context from antiquity to the present. *(Lec. 3)* Tryon

513 Intellectual Freedom and Censorship *(I or II, 3)* Historical development and current status of the concept of intellectual freedom and the restraints that past and present societies have imposed on it. Special attention given to the librarian's role in defense of intellectual freedom. *(Lec. 3)* Tryon

520 The School Library Media Center *(I, 3)* The relationships of school library media centers to school programs and curriculums with an emphasis on administration, services, and functions. *(Lec. 3) Pre: 502 or permission of instructor.* Jensen

521 Public Library Service *(I or II, 3)* Methods for management and planning in public libraries for creating programs, and for evaluating services and their effects on the public served. The identification of alternative solutions to budgeting and personnel management problems. *(Lec. 3) Pre: 502.* Siitonen and Zipkowitz

522 College and University Library Service *(II, 3)* Study of the functions, organization, management, and services of college and university libraries. *(Lec. 3) Pre: 502.* Tryon and Zipkowitz

523 Special Library Service *(I or II, 3)* Organization, management, and procedures as they apply to special libraries with particular emphasis on the diversity of special library functions. *(Lec. 3) Pre: 502.* Kellerman and Stankus

528 Media in the Library *(I or II, 3)* The role of multimedia materials in library and information settings, including the selection, evaluation, organization, and utilization of audiovisual hardware and software, and an introduction to emerging communication technologies. *(Lec. 3)* Carson

529 Theory and Production of Library Media Communications *(I or II, 3)* Introduction to the design and production of graphic, photographic, audio, video, and computer-based materials for library and information environments through the application of basic communication, perception, and learning theories. *(Lec. 3)* Carson

530 Reading Interests of Children *(I or II, 3)* A survey of children's literature as it relates to the reading interests and information needs of children. Emphasis is on collection building, reference, reading guidance, and book promotion. *(Lec. 3) Pre: 503 or permission of instructor.* Eaton

531 Reading Interests of Young Adults *(I or II, 3)* Overview of young adult literature in the context of the special interests and information needs of adolescence. Emphasis on the building, use, and promotion of the young adult collection. *(Lec. 3) Pre: 503 or permission of instructor.* Eaton

536 Storytelling *(I or II, 3)* Selection, adaptation, and presentation of stories for children of all ages, including attention to sources of materials, planning the story hour, and training and practice in the art of storytelling. *(Lec. 3)* Daigneault

537 Health Sciences Librarianship *(II, 3)* Introduction to the nature and operation of health science libraries and an overview of health science bibliography. *(Lec. 3) Pre: 502 and 504 or permission of instructor.* Kellerman

538 Law Librarianship *(I, 3)* Introduction to legal bibliography and research and to a broad range of problems involved in the administration and operation of various kinds of law libraries. *(Lec. 3) Pre: 502 and 504 or permission of instructor.* Svengalis

540 Library Materials in the Humanities *(I or II, 3)* Library resources in the humanities, including the major works, serial publications, and reference and bibliographical materials. *(Lec. 3) Pre: 503 and 504.* Schneider

541 Library Materials in the Social Sciences *(I or II, 3)* Library resources in the social sciences, including the major works, serial publications, and reference and bibliographical materials. *(Lec. 3) Pre: 503 and 504.* Schneider

542 Library Materials in Science and Technology *(I or II, 3)* Library resources in science and technology, including the major works, serial publications, and reference and bibliographical materials. *(Lec. 3) Pre: 503 and 504.* Carson

543 Government Publications *(I or II, 3)* Survey of the publishing activities and publications of national, state, and local governments with emphasis on the publications of the United States government. *(Lec. 3) Pre: 504.* Schneider

544 Information Science for Librarians *(I or II, 3)* An introduction to the interdisciplinary study of information science related to information (data) collection, analysis, processing, transmission, utilization, and communication, with emphasis on bibliographic data and its retrieval in modern libraries and information centers. *(Lec. 3) Pre: 502 and 504 or permission of instructor.* Siitonen

546 Computer Systems in Library Automation *(I or II, 3)* Introduction to principles of systems analysis and the tools of analysis. Study of computer hardware and software and the application of new technologies to library operations and services. *(Lec. 3) Pre: 501 or permission of instructor.* Jensen

547 Online Searching and Services *(I or II, 3)* Introduction to computerized information retrieval and the provision of computerized information services in libraries, including hands-on experience. *(Lec. 2, Lab. 1) Pre: 501 and 504.* Schneider and Siitonen

548 Microcomputer Applications in Library and Information Services *(I or II, 3)* Selection, evaluation, and integration of hardware and software specific to functions of different types of libraries and information centers. *(Lec. 3) Pre: 501 or permission of instructor.* Siitonen and Carson

549 Information Storage and Retrieval *(I or II, 3)* Theory and methods of analyzing, storing, and retrieving primarily bibliographic information and their applications in libraries and information services. Operation, monitoring, and evaluation of manual and computerized retrieval systems. *(Lec. 2, Lab. 1) Pre: 501.* Siitonen

550 Advanced Cataloging *(I or II, 3)* Theory and problems in descriptive and subject cataloging and classification with emphasis on the use of Library of Congress subject headings and classification. Includes editing of original and copy cataloging for OCLC. Emphasis is on microforms, serials, rare books, music and sound recordings. *(Lec. 3) Pre: 505.* Zipkowitz

551 Organization of Nonprint Materials *(I or II, 3)* A practical and theoretical study of the development of procedures for intellectual and physical access to materials not in conventional print form, including maps and vertical file materials. *(Lec. 3) Pre: 505.* Jensen

560 Research in Librarianship *(I or II, 3)* Types and methods of research, introduction to and evaluation of the literature of the field. *(Lec. 3) Pre: permission of instructor.* Eaton

562 Administration of Special Collections, Archives, and Manuscripts *(I, 3)* Principles and techniques for administering manuscript and archival repositories, including acquisition policies, appraisal criteria, methodology, and preservation practices. *(Lec. 3) Pre: core courses or permission of instructor.* Maslyn

564 Introduction to Library Conservation *(I or II, 3)* Fundamentals of effective management for programs of preventive and restorative conservation for paper products and other library materials. *(Lec. 3)* Cloonan

565 Rare Book Librarianship *(I or II, 3)* Organization, management, principles, and techniques as they apply to the development and administration of rare book collections. *(Lec. 2, Lab. 2) Pre: 510 or permission of instructor.* Tryon

591, 592, 593 Independent Work *(By appt., 1–3 each)* Supervised reading or investigation in areas of special interest to students who obtain written approval for such study prior to registration for the semester for which it is proposed. *Pre: 18 hours of library science with a B average. May be repeated for a maximum of 3 credits.* Staff

595 Professional Field Experience *(I and II, 1–3)* Directed field experience applying theory to practice in libraries, information centers, and related organizations under the joint supervision of a member of the faculty and the professional staff of the cooperating institutions. *(45 hours per credit) Pre: completion of at least 18 hours of library science with a B average. May be repeated for a maximum of 3 credits.* Staff

596 School Library Media Center Practicum *(II, 3–6)* Directed field experience applying theory to practice in school library media centers under the joint supervision of a faculty member and the professional staff of the cooperating school. *(45 hours per credit) Pre: 520 and completion of at least 18 hours of library science.* Jensen

597 Selected Topics *(I and II, 3)* Selected topics in library and information studies of current and special interest not covered in existing course offerings. Topics announced prior to each offering. *(Lec. 3) Pre: 501 and permission of instructor.* Staff

693 Special Problems Seminar *(I, 3)* An introductory seminar in advanced librarianship for students in the Diploma in Advanced Librarianship program, where important research topics are identified, explored, and presented by students in class. *(Lec. 3) Pre: master's degree in librarianship or related field.* Staff

698 DAL Research Project *(I and II)* Research project for the Diploma in Advanced Librarianship resulting in a substantial paper. Number of credits is determined each semester in consultation with the major professor or program committee.

Manufacturing Engineering
M.S.

Graduate Faculty

Chairperson: Professor Geoffrey Boothroyd, Ph.D., 1962, D.Sc., 1974, University of London
Director of Graduate Studies: Professor Peter Dewhurst, Ph.D., 1973, University of Manchester
Professor Winston A. Knight, Ph.D., 1967, Birmingham University
Professor Edward Nichols, Ph.D., 1958, Purdue University
Associate Professor William D. Lawing, Jr., Ph.D., 1965, Iowa State University
Associate Professor David M. Shao, Ph.D., 1970, State University of New York, Buffalo
Adjunct Professor Charles C. Reynolds, Ph.D., 1963, Massachusetts Institute of Technology

Specializations

Fundamentals of manufacturing processes, manufacturing automation, product design for efficient manufacture, and the organization of manufacturing systems.

Master of Science

Admission requirements: GRE and B.S. degree in industrial, manufacturing, or mechanical engineering. An applicant with a B.S. degree in another field of engineering, mathematics, physics, chemistry, or computer science will be considered; such applicants will be required to complete some deficiency courses.

Program requirements: 30 credits including thesis (6 credits); IME 542; IME 544 and 549 or 591, 592, and a graduate elective; 3 credits each from the areas of fundamentals of manufacturing processes and manufacturing properties of materials, control and organization of manufacturing systems, and computer systems in manufacturing engineering and design. IME 340 or equivalent is a prerequisite.

Doctor of Philosophy

Please see the listing under Applied Mathematical Sciences on page 24.

Special Financial Aid

Research assistantships and part-time professional employment in local industries and hospitals.

IME Courses
Industrial and Manufacturing Engineering

404 Engineering Economy *(I and II, 3)*
411 Probability for Engineers *(I, 3)*
412 Statistics for Engineers *(II, 3)*
430 Design and Analysis of Compensation Systems *(II, 3)*
432 Operations Research: Deterministic Models *(I, 3)*
433 Operations Research: Stochastic Models *(II, 3)*
435 Introduction to Operations Research *(I and II, 3)*
441 Metal Castings *(II, 3)*
443 Machining and Machine Tools *(II, 3)*
444 Assembly and Handling Automation *(I, 3)*
446 (or MCE 446) Metal Deformation Processes *(II, 3)*
449 (or MCE 449) Product Design for Manufacture *(I, 3)*
450 Computer-Aided Industrial and Manufacturing Engineering *(I, 3)*
451 Industrial Engineering Systems *(II, 3)*
491, 492 Special Problems *(I and II, 1–6 each)*

500 Network Application in Industrial Engineering *(II, 3)* Industrial systems problems that can be formulated in terms of flows in networks. Critical path scheduling,

transportation problems, allocation, sequencing, line balancing, etc. *(Lec. 3) Pre: 432 and permission of instructor. In alternate years.* Shao

513 Statistical Quality Assurance *(I, 3)* Topics in statistical quality control systems. Single, multiple, and sequential sampling. Design and analysis of a wide variety of statistical control systems used in conjunction with discrete and continuous data, for several kinds of data emission. *(Lec. 3) Pre: 412 or equivalent.* Nichols

514 Special Topics in Statistical Quality Assurance *(II, 3)* Quality control evaluation and monitoring systems for short-run production processes; analysis of critical specifications in small limited sample opportunities; sequential analyses; statistical procedures for troubleshooting; small sample strategies. *(Lec. 3) Pre: 412 or equivalent or permission of instructor.* Nichols

517 Applied Control Theory in Industrial Engineering *(I, 3)* Complex control mechanisms will be studied and applied to production and manufacturing operation. Automatic control systems for production and manufacturing will be designed and analyzed. *(Lec. 3) Pre: 404, MTH 244, and permission of instructor.* Staff

525 Simulation
See Computer Science 525.

533 Advanced Statistical Methods for Research and Industry *(I, 3)* Estimation and testing; regression and correlation; analysis of variance and related topics. Applications in industrial operations and engineering research. *(Lec. 3) Pre: 411 or permission of instructor.* Lawing

535 Industrial Reliability Engineering *(II, 3)* Theories of reliability applicable to the design and operations of manufacturing processes and product quality assurance control systems. Quantitative analyses of economic specifications, performance levels, maintenance levels, and redundancy systems. *(Lec. 3) Pre: permission of instructor.* Nichols

540 Production Control and Inventory Systems *(I, 3)* Theory and practice of industrial production control and inventory systems. A broad spectrum of mathematical models for static, dynamic, perpetual, and periodic inventory systems as they affect and relate to production. *(Lec. 3) Pre: permission of instructor.* Staff

541 Materials Processing and Metrology II *(I, 3)* Continuation of 340. Engineering analyses in the processing of materials. Dynamic coupling, tool-work-piece interaction, energy and thermal analysis; mechanics of material removal and displacements, advanced topics in mechanical electrical systems for processing of materials. *(Lec. 3) Pre: 440 or permission of instructor.* Staff

542 Introduction to Computer-Aided Manufacturing *(I, 3)* Use of computers in manufacturing. Planning and control of manufacturing facilities and operations. Group technology, flow lines, optimization of machining conditions, numerical and adaptive control, automation, robotic applications. *(Lec. 3) Pre: 442 or permission of instructor.* Knight

543 Fundamentals of Machining *(II, 3)* Fundamental treatment of the mechanics and economics of metal machining and grinding. Includes an introduction to numerical control and computer-aided programming of CNC machine tools. *(Lec. 3) Pre: CVE 220 and IDE 340.* Boothroyd, Dewhurst, and Knight

544 Automatic Assembly *(I, 3)* Types and economics of automatic assembly systems. Analysis of automatic feeding and orienting techniques for small parts. Application of robots in assembly. Economics of assembly systems for printed circuit boards. *(Lec. 3) Pre: 440 or permission of instructor. Not for graduate credit for students with credit in 444.* Boothroyd and Dewhurst

545 Manufacturing Systems: Analysis, Design, Simulation *(I, 3)* Problems in manufacturing system analysis and design. Quantitative models and simulation methods applied to production planning, control, scheduling, resource allocation, and decision making in various types of manufacturing systems. *(Lec. 3) Pre: 433 or permission of instructor.* Shao

546 Advanced Metal Deformation Processes *(II, 3)* Theory of metal flow under different loading conditions. Prediction of metal forming process capabilities. Advanced topics include effects of anisotropy and mechanics of powder forming. *(Lec. 3) Pre: 340 or permission of instructor. Not for graduate credit for students with credit in 446.* Dewhurst

549 (or MCE 549) Advanced Product Design for Manufacture *(I, 3)* Techniques for analyzing product structures for ease of assembly and manufacture. Considers mechanical and electronic products and choice of materials and processes. A design project and term paper are required. *Pre: 240 or 340 and credit or current enrollment in 444. Not for graduate credit for students with credit in 449.* Dewhurst or Boothroyd

550 Design for Producibility *(II, 3)* Addresses the capabilities of primary shape-generating processes. Concentration on manufacturability guidelines and on the effects of design decisions on material choice, processing times, and tooling costs. *(Lec. 3) Pre: 449 or 549.* Knight or Dewhurst

555, 556 Engineering Applications of Mathematical Programming I, II *(I and II, 3 each)* Sensitivity analysis and pricing problems, practical problems in degeneracy and duality, decomposition methods for large-scale systems, applied convex, integer, nonlinear, and quadratic programming methods. An introduction to stochastic programming. *(Lec. 3) Pre: 432 for 555 and permission of instructor; 555 for 556 and permission of instructor. In alternate years.* Staff

565 Theory of Scheduling *(II, 3)* Sequencing problems, finite sequencing for a single machine n/m job shop problems with analytical and heuristic procedures, networks applied to scheduling, queuing systems in scheduling, probabilistic scheduling problems. Survey of selected literature. *(Lec. 3) Pre: permission of instructor. In alternate years. Next offered 1989–90.* Shao

591, 592 Special Problems *(I and II, 1–6 each)* Advanced work under supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. or Lab. according to the nature of the problem) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

610 Topics in Applied Queuing Theory *(I, 3)* Poisson and Erland queues, imbedded chains, M/G/1 and G/M/1 queues, and related topics in queuing theory. Analysis of a wide variety of queues with an applications orientation. *(Lec. 3) Pre: 433 or permission of instructor. In alternate years. Next offered 1989–90.* Staff

634 Design and Analysis of Industrial Experiments *(II, 3)* Further development of topics in analysis of variance. Randomized blocks, Latin squares and related designs, factorial experiments, confounding and fractional replications, and split-plot designs. Design and analyses of engineering experiments. *(Lec. 3) Pre: 533.* Lawing

635 (or EST 635) Response Surfaces and Evolutionary Operations *(II, 3)* Methods of determining the response surface for multiple factors over a specified range and techniques for seeking an optimum. First- and second-order response surfaces. Rotatable second-order design. Central composite rotatable designs. Multivariable EVOP programs and other topics in evolutionary operations. *(Lec. 3) Pre: 533 or equivalent.* Lawing

660 Methods of Optimization *(II, 3)* Methods of optimization: indirect, direct elimination, climbing. Geometric programming. Problems and other topics in applied optimization. *(Lec. 3) Pre: CSC 500 and permission of instructor. In alternate years. Next offered 1989–90.* Staff

691, 692 Advanced Special Problems in Industrial Engineering *(I and II, 1–6 each)* Advanced work under the supervision of a staff member arranged to suit the individual

requirements of the student. *(Lec.* or *Lab. according to nature of problems) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

Marine Affairs

M.A., M.M.A.

Graduate Faculty

Chairperson: Professor Lawrence Juda, Ph.D., 1973, Columbia University
Professor Lewis M. Alexander, Ph.D., 1949, Clark University
Professor John A. Knauss, Ph.D., 1959, University of California
Professor Aloys A. Michel, Ph.D., 1959, Columbia University
Professor Niels West, Ph.D., 1973, Rutgers—The State University
Associate Professor Richard H. Burroughs, Ph.D., 1974, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution
Associate Professor Bruce E. Marti, Ph.D., 1982, University of Florida
Associate Professor Dennis W. Nixon, J.D., 1975, University of Cincinnati; M.M.A., 1976, The University of Rhode Island
Assistant Professor Gerald H. Krausse, Ph.D., 1975, University of Pittsburgh
Adjunct Professor Claiborne D. Pell, M.A., 1946, Columbia University
Adjunct Professor Gerald Seifert, J.D., 1964, Indiana University; M.M.A., 1978, The University of Rhode Island
Adjunct Associate Professor Jens C. Sorensen, Ph.D., 1978, University of California, Berkeley

Specializations

Coastal zone management, marine transportation and port planning, fisheries law and management, international marine policy and law, marine geography.

Master of Arts (M.A.)

Admission requirements: GRE and bachelor's degree in related science or social science. For international students, minimum TOEFL score of 575. Full-time applicants are admitted for September only.

Program requirements: thesis and MAF 482, 502, 571, 577, 651, 652; MAF 511 or appropriate oceanography substitute; REN 514 or appropriate resource economics substitute; plus a minimum of 15 elective credits for a total of 45 credits.

Master of Marine Affairs (M.M.A.)

Admission requirements: GRE, prior graduate degree or five years of equivalent experience in marine areas. For international students, minimum TOEFL score of 575. Applicants are admitted for September only.

Program requirements: nonthesis program; MAF 571, 577, 651, 652; REN 514; MAF 511 or appropriate oceanography substitute; plus 12 elective credits for a total of 30 credits; written comprehensive examination.

Graduate Certificate Program in Commercial Fisheries

As an adjunct to the Master of Marine Affairs program, an additional 15-credit program, leading to a graduate certificate awarded by the dean of the Graduate School, is offered in commercial fisheries. The joint 45-credit program is designed to combine the evaluative use and control aspects of the M.M.A. curriculum with the technology and performance of the marine commercial fisheries.

Admission requirements: GRE, appropriate background or undergraduate preparation, and concurrent enrollment in the M.M.A. program.

Program requirements: FMT 518, 591, plus 9 credits selected from the following electives—FMT 415, 452, 521; MAF 523; APG 413; OCG 670; REN 543.

Financial aid: assistantships, fellowships, and scholarships are not available to participants in the graduate certificate program as such, but may be held by students concurrently enrolled in the M.M.A. program.

MAF Courses
Marine Affairs

410 Problems in Geography and Marine Affairs *(II, 3)*
413 (or APG 413) Peoples of the Sea *(I, 3)*
456 Polar Resources and Policy *(I, 3)*
461 Coastal Zone Uses *(I, 3)*
471 Island Systems *(II, 3)*
472 Marine Recreation Management *(II, 3)*
482 Quantitative Methods in Marine Affairs *(II, 3)*
491, 492 Special Problems *(I and II, 3 each)*
499 Directed Study *(I and II, 1–3)*

502 Research Methods in Geography and Marine Affairs *(I, 3)* Emphasis on the application of alternative research methods utilized in a typical interdisciplinary study. Development of specific research projects. *Pre: 482 or permission of chairperson. (Lec. 3)* Marti

511 Ocean Uses and Marine Science *(II, 3)* Introduction to selected ocean uses focusing on the interplay of public policy and marine science. Emphasis on policy implications of uses such as resource and energy extraction and waste disposal. *(Lec. 3)* Burroughs

512 (or PSC 512) Seminar in Marine Science Policy and Public Law *(II, 3)* Examination of the interplay of science, policy, and law in the formulation and implementation of domestic policy in areas such as waste management and the environment. *Pre: permission of chairperson.* Burroughs

516 (or CPL 516) Seminar on the Urban Waterfront *(I, 3)* The urban environment, its evolution, structure, and function as it relates to the waterfront. Topics on policy, management, and utilization on the local and regional level will be covered. Field trip and student project required. *Pre: credit or concurrent enrollment in marine affairs or community planning or permission of instructor.* Krausse

520 Seminar in Coastal Margin Management *(II, 3)* Nature of oil, gas, and other mineral resources on the outer continental shelf, public and private sector decisions, and environmental issues are reviewed. Emphasis on the utility of data for policy development. *(Sem. 3) Pre: permission of instructor.* Burroughs

521 Coastal Zone Law *(II, 3)* Examination of the authority of different levels and agencies of government to make decisions affecting coastal regions. Survey of existing and proposed state and national legislation affecting coastal regions. *(Lec. 3)* Marti

523 Fisheries Law and Management *(II, 3)* Examination of the relationship between law and fisheries policy on the international and national level, law relating to fisheries, jurisdictional levels, function of law in implementing fisheries management policy. *(Lec. 3) Pre: permission of instructor.* Nixon

526 LANDSAT Remote Sensing and Analysis *(II, 3)* Theory and application of the LANDSAT remote sensing system and geographical information systems emphasizing coastal resource surveillance. Development and interpretation of supervised and unsupervised classifications from digitized reflectance values obtained from the MS and TM scanners. *Pre: 482 or permission of instructor.* West

562 Admiralty Law *(I, 3)* Fundamentals of admiralty law: collisions at sea, bills of lading, marine insurance, and rights of seamen. Case studies of marine transportation problems and their resolution by law. *(Lec. 3) Pre: permission of chairperson.* Nixon

563 Maritime Transportation *(II, 3)* Passenger and commodity transportation. Analysis of the relationship between transportation services and the spatial distribution of activities. Emphasis on multimodel transport and bulk commodities. *(Lec. 3) Pre: senior or graduate standing and permission of instructor.* Marti

564 Port Operations and Policy *(II, 3)* Analysis of coastal and international trade routes and the response of ports. Special emphasis on the container revolution, liquid natural gas transportation, and deepwater ports for supertankers. *(Lec. 3)* Marti

571 Marine Geography *(I, 3)* The marine region as a unique complex of physical and cultural elements. The purpose is to analyze functional relationships within the region and to assess forms of regional organization and control. *(Lec. 3) Pre: permission of chairperson.* Alexander

572 Management of Ocean Regions *(II, 3)* A global study of the nature and use of ocean basins, semi-enclosed seas, and other marine areas, with special emphasis on regional arrangements and regimes. *(Lec. 3) Pre: 571 or permission of chairperson. In alternate years.* Alexander

577 (or PSC 577) International Ocean Law *(I, 3)* Principles of international law as they relate to ocean management problems. Jurisdiction in the territorial sea, contiguous zones, and the deep seabed will be examined within the international legal framework. *(Lec. 3) Pre: 312, CPL 434, or permission of instructor.* Juda

578 International Ocean Organizations *(II, 3)* International organizations involved in marine-related activities, including their planning, management, and regulatory and assistance functions. Attention to the impact of these organizations on national policies in the developed and developing worlds. *(Lec. 3) Pre: 577 or permission of instructor.* Juda

579 Marine Jurisdictional Issues *(II, 3)* Examination and analysis of national controls in the oceans, including international and domestic maritime boundaries, types of offshore zones, and claims to special jurisdictional rights. *(Lec. 3) Pre: 571 or 577 or permission of instructor.* Alexander

586 Environmental Impact Assessment and Analysis *(II, 3)* A survey of environmental legislation and proposed guidelines, together with a review of physical and socioeconomic methods of environmental analysis and assessments. Preparation of environmental impact statements. *(Lec. 3) Pre: BOT 262 or permission of instructor.* West

591, 592 Directed Study or Research *(I and II, 3)* Areas of special research interest of graduate students. *(Lec. 3) Pre: permission of chairperson.* Marti

595 Problems of Modernization in Developing Nations
See Resource Economics 595.

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.* Marti

602 Federal Ocean Policy and Organization *(II, 3)* Ocean policy development and implementation by the executive and legislative branches of government. Allocation of powers and analysis of the decision-making process for the oceans. *(Lec. 3) Pre: permission of chairperson.* Juda

651, 652 Marine Affairs Seminar *(I and II, 3 each)* Interdisciplinary seminar conducted by marine affairs program faculty supplemented by guest speakers from industry and government. Focuses on problems of marine resources development and management at the local, state, national, and international policy levels. *(Lec. 3) Pre: permission of chairperson.* Alexander, Burroughs, Juda, Krausse, Marti, Nixon, and West

Mathematics
M.S., Ph.D.

Graduate Faculty

Chairperson: Professor John T. Montgomery, Ph.D., 1971, University of Wisconsin
Professor Raymond A. Beauregard, Ph.D., 1968, University of New Hampshire
Professor Dilip K. Datta, Ph.D., 1963, Delhi University
Professor Rodney D. Driver, Ph.D., 1960, University of Minnesota
Professor John B. Fraleigh, M.A., 1956, Princeton University
Professor Edward A. Grove, Ph.D., 1969, Brown University
Professor Gerasimos Ladas, Ph.D., 1968, New York University
Professor James T. Lewis, Ph.D., 1969, Brown University
Professor Pan-Tai Liu, Ph.D., 1968, State University of New York, Stony Brook
Professor Emilio O. Roxin, Ph.D., 1959, University of Buenos Aires
Professor Sol Schwartzman, Ph.D., 1953, Yale University
Professor Oved Shisha, Ph.D., 1958, Hebrew University
Professor Robert C. Sine, Ph.D., 1962, University of Illinois
Professor E. Ramnath Suryanarayan, Ph.D., 1961, University of Michigan
Professor Ghasi Ram Verma, Ph.D., 1957, Rajasthan University
Associate Professor Dean Clark, Ph.D., 1978, Brown University
Associate Professor Norman J. Finizio, Ph.D., 1972, Courant Institute of Mathematical Sciences, New York University
Associate Professor Barbara Kaskosz, Ph.D., 1977, Polish Academy of Science
Associate Professor Lewis I. Pakula, Ph.D., 1972, Massachusetts Institute of Technology
Assistant Professor Robert A. Barron, M.A., 1955, Fordham University
Assistant Professor Diane Johnson, Ph.D., 1983, University of Oregon
Adjunct Professor Charles F. Osgood, Ph.D., 1964, University of California, Berkeley
Adjunct Assistant Professor David H. Wood, Ph.D., 1972, The University of Rhode Island
Associate Professor Emeritus Roderick P. Caldwell, Ph.D., 1962, University of Illinois

Specializations

Ordinary, functional, and stochastic differential equations, partial differential equations, abstract differential equations, functional analysis, approximation theory, probability, fluid mechanics, control theory, and differential games.

Master of Science

Admission requirements: GRE with advanced test in mathematics, bachelor's degree with strong undergraduate background in mathematics. Applicants with deficiencies in mathematics may be accepted subject to taking certain undergraduate courses in addition to the graduate program requirements. Applicants without a bachelor's degree who have completed at least 60 credits of undergraduate work and have an outstanding record in mathematics as evidenced by transcripts, letters of recommendation, and outstanding performance on the Graduate Record Examination also may be accepted.

Program requirements: 30 credits (or 24 plus thesis), including at least 18 credits in mathematics of which at least 12 must be at the 500 level or above. A course requiring a substantial paper involving significant independent study and a written comprehensive examination are required for the nonthesis option. MTH 435 and 513 must be completed with a grade of A or B. Recommended courses include MTH 515, 525, 535, 536, and 562.

Doctor of Philosophy

Admission requirements: same as for master's program.

Program requirements: MTH 513, 515, 525, 535, 536, and 562, plus specialized courses and electives. Reading ability (in candidate's specialty and with a dictionary) in one language chosen from French, German, or Russian. An oral qualifying examination is required of all candidates.

Please also see the listing under Applied Mathematical Sciences on page 24.

General Information

Programs of study can be designed for individuals who are employed on a full-time basis.

MTH Courses
Mathematics

418 Matrix Analysis *(II, 3)*
420 Topics in Foundations *(I, 3)*
425 Topology *(I, 3)*
435, 436 Introduction to Mathematical Analysis I, II *(I and II, 3 each)*
437, 438 Advanced Calculus and Applications *(I and II, 3 each)*
441 Introduction to Partial Differential Equations *(I, 3)*
444 Ordinary Differential Equations *(II, 3)*
447 (or CSC 447) Discrete Mathematical Structures *(I, 3)*
451 Introduction to Probability and Statistics *(I, 3)*

452 Mathematical Statistics *(II, 3)*
456 Introduction to Random Processes *(II, 3)*
461 Methods of Applied Mathematics *(I, 3)*
462 Functions of a Complex Variable *(II, 3)*
464 Advanced Engineering Mathematics *(II, 3)*
471 Introduction to Numerical Analysis I *(I and II, 3)*
472 Introduction to Numerical Analysis II *(II, 3)*
492 Special Problems *(I and II, 1–3)*

513 Linear Algebra *(I, 3)* Linear spaces and transformations, linear functionals, adjoints, projections, diagonalization, Jordan form of matrices, inner products; positive, normal, self-adjoint, and unitary operators; spectral theorem, bilinear and quadratic forms. *(Lec. 3)* Staff

515, 516 Algebra I, II *(I and II, 3 each)* Groups, rings, modules, commutative algebra. *(Lec. 3) Pre: 316. In alternate years. Next offered 1990–91.* Staff

525 Topology *(II, 3)* Topological spaces, separation properties, connectedness, compactness, uniformities. Function spaces, spaces of continuous functions, and complete spaces. *(Lec. 3) Pre: 425 or equivalent. In alternate years. Next offered spring 1990.* Staff

535, 536 Measure Theory and Integration *(I and II, 3 each)* Elements of topology and linear analysis. Lebesgue measure and integration in R, in R^n, and in abstract spaces. Convergence theorems. Bounded variation, absolute continuity, and differentiation. Lebesgue-Stieltjes integral. Fubini and Tonelli theorems. The classical Banach spaces. *(Lec. 3) Pre: 435.* Staff

545, 546 Ordinary Differential Equations I, II *(I and II, 3 each)* Existence and uniqueness theorems. Continuous dependence on parameters and initial conditions. Singularities of the first and second kinds, self-adjoint eigenvalue problems on a finite interval. Oscillation and comparison theorems. Introduction to delay and difference equations. Elements of stability theory of Lyapunov's second method. *(Lec. 3) Pre: 435. In alternate years. Next offered 1989–90.* Staff

547 (or CSC 547) Combinatorics and Graph Theory *(I, 3)* Enumeration: generating functions, recurrence relations, classical counting numbers, inclusion-exclusion, combinatorial designs. Graphs and their applications: Euler tours, Hamilton cycles, matchings and coverings in bipartite graphs, the four-color problem. *Pre: 215 or equivalent. In alternate years. Next offered fall 1989.* Staff

548 Topics in Combinatorics *(II, 3)* Topics such as Ramsey theory, Polya theory, network flows and the max-flow-mincut variations, applications in operations research; finite fields and algebraic methods; block designs, coding theory, other topics. *Pre: 547 or permission of instructor. In alternate years. Next offered spring 1990.* Staff

550 Probability and Stochastic Processes *(I, 3)* Review of probability theory. Generating functions, renewal theory, Markov chains and processes, Brownian motions, stationary processes. *(Lec. 3) Pre: 435, 437, 451, or permission of instructor. In alternate years. Next offered fall 1990.* Staff

551 Mathematical Statistics *(II, 3)* Theory of estimation and hypothesis testing. Large sample methods. Regression and analysis of variance. *(Lec. 3) Pre: 435, 437, 451, or permission of instructor. In alternate years. Next offered spring 1991.* Staff

561 Advanced Applied Mathematics *(II, 3)* Linear spaces, theory of operators. Green's functions, eigenvalue problems of ordinary differential equations. Application to partial differential equations. *(Lec. 3) Pre: 461.* Staff

562 Complex Function Theory *(I, 3)* Analytic continuation, Riemann surfaces. The theory of conformal mapping. Representation theorems and applications. Entire functions. *(Lec. 3) Pre: 462. In alternate years. Next offered fall 1990.* Staff

572 Numerical Analysis *(II, 3)* Further numerical methods of solution of simultaneous equations, partial differential equations, integral equations. Error analysis. *(Lec. 3) Pre: 472.* Staff

591, 592 Special Problems *(I and II, 1–3 each)* Advanced work under the supervision of a member of the department arranged to suit the individual requirements of the student. *Pre: permission of chairperson.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

629, 630 Functional Analysis I, II *(I and II, 3 each)* Banach and Hilbert spaces, basic theory. Bounded linear operators, spectral theory. Applications to analysis. Application to a special topic such as differential operators, semigroups and abstract differential equations, theory of distributions, or ergodic theory. *(Lec. 3) Pre: 536 or permission of instructor.* Staff

641 Partial Differential Equations I *(I, 3)* First order systems. The Cauchy-Kowalewsky theorem. The Cauchy problem. Classification of partial differential equations. Hyperbolic equations. Mainly the theory of the subject. Students interested in techniques for the solution of standard equations should take 441. *(Lec. 3) Pre: 215, 435, and 462. In alternate years. Next offered fall 1990.* Staff

642 Partial Differential Equations II *(II, 3)* Elements of potential theory. Elliptic equations. Green's function. Parabolic equations. Introduction to the theory of distributions. *(Lec. 3) Pre: 641. In alternate years. Next offered spring 1991.* Staff

691, 692 Special Topics I, II *(I and II, 3 each)* Advanced topics of current research in mathematics will be presented with a view to expose the students to the frontiers of the subject. *(Lec. 3) Pre: permission of chairperson.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Mechanical Engineering and Applied Mechanics

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Thomas J. Kim, Ph.D., 1967, University of Illinois
Director of Graduate Studies: Professor Martin H. Sadd, Ph.D., 1971, Illinois Institute of Technology
Professor George A. Brown, Sc.D., 1960, Massachusetts Institute of Technology
Professor Philip Datseris, Ph.D., 1977, Columbia University
Professor Frank DeLuise, M.S., 1950, The University of Rhode Island
Professor William R. Ferrante, Ph.D., 1962, Virginia Polytechnic Institute
Professor Hamouda Ghonem, Ph.D., 1978, McGill University
Professor Warren M. Hagist, M.E., 1961, Harvard University
Professor Jack P. Henderson, Ph.D., 1980, Oklahoma State University
Professor Richard C. Lessmann, Ph.D., 1969, Brown University
Professor Charles D. Nash, Jr., Ph.D., 1959, Ohio State University
Professor William J. Palm, Ph.D., 1971, Northwestern University
Professor Arun Shukla, Ph.D., 1981, University of Maryland
Professor Frederick L. Test, Ph.D., 1956, Pennsylvania State University
Professor Hermann Viets, Ph.D., 1970, Polytechnic Institute of Brooklyn
Professor Frank M. White, Ph.D., 1959, Georgia Institute of Technology
Professor Mason P. Wilson, Jr., Ph.D., 1968, University of Connecticut
Associate Professor Mohammad Faghri, Ph.D., 1973, Oregon State University
Assistant Professor Daniel G. Olson, Ph.D., 1987, University of Minnesota
Assistant Professor David G. Taggart, Ph.D., 1988, University of Pennsylvania
Adjunct Professor Alexander J. Patton, Ph.D., 1972, The University of Rhode Island
Adjunct Associate Professor Richard H. Messier, Ph.D., 1975, Brown University
Adjunct Research Professor Richard Dunlap, M.S., 1941, Massachusetts Institute of Technology

Specializations

Fluid mechanics: boundary layer theory, separated flows, turbulence, particle flow

interactions, geophysical flows, flow measurement, computational methods.

Robotics and design: robotics, expert systems, kinematics, design optimization, lubrication theory, dynamic face seals, reliability analysis and prediction, computer-aided design, manufacturing.

Solid mechanics: elasticity, plasticity, continuum mechanics, fracture mechanics, fatigue, photomechanics, wave propagation and dynamic geomechanics, computational methods including finite element and boundary element methods, composite and ceramic material behavior, micromechanics, nonlinear mechanics, mechanics of waterjet processing.

Systems and control: robotics, mathematical modeling of control systems, stability, nonlinear systems, microprocessor and digital control, advanced dynamics, lumped and distributed parameter vibration theory.

Thermal science: anisotropic heat conduction, convection heat transfer, thermal characteristics of ablative materials, direct energy conversion, solar energy developments, new engine developments, viscoelastic fiber processes, thermal pollution, solar collector systems, computational heat transfer.

Master of Science

Admission requirements: GRE, B.S. degree in mechanical engineering, applied mechanics, aerospace engineering, or in a related field such as engineering science, civil engineering, applied mathematics, applied physics. Students admitted to the program will be expected to have the equivalent of MCE 372 and 373. Students without this background may be required to make up this deficiency with no program credits.

Program requirements: thesis option—30 credits exclusive of seminar, a thesis is required of all full-time students, one course outside the area of specialization; MCE 501, 502, graduate seminar required of all on-campus students. Nonthesis option for part-time students—permission of chairperson, 33 credits exclusive of seminar, including one course outside of the specialization, one course requiring a substantial paper involving significant independent study, and a comprehensive examination.

Financial aid: a number of graduate and research assistantships are available for qualified M.S. students.

Doctor of Philosophy

Admission requirements: master's degree and GRE.

Program requirements: Ph.D. qualifying examination, dissertation; completion of a minimum of 24 credits beyond the master's degree, exclusive of seminar; MCE 501, 502, graduate seminar required of all on-campus students.

Financial aid: a number of graduate and research assistantships are available for qualified Ph.D. students. Temporary instructorships may be available for highly qualified Ph.D. students.

General Information

Programs of study can be designed for individuals who are employed on a full-time basis.

MCE Courses Mechanical Engineering and Applied Mechanics

423 Design of Machine Elements *(I, 3)*
425 Lubrication and Bearings *(I, 3)*
426 Advanced Mechanics of Materials *(I, 3)*
428 Mechanical Control Systems *(I, 3)*
429 Comprehensive Design *(II, 3)*
430 Computer-Aided Design *(II, 3)*
431 Computer Control of Mechanical Systems *(I, 3)*
434 Thermal Environmental Engineering *(II, 3)*
438 Internal Combustion Engines *(I, 3)*
439 Applied Energy Conversion *(II, 3)*
440 Mechanics of Composite Materials *(I or II, 3)*
446 (or IME 446) Metal Deformation Processes *(I, 3)*
448 Heat and Mass Transfer *(I, 3)*
449 (or IME 449) Product Design for Manufacture *(II, 3)*
455 Advanced Fluid Mechanics *(I, 3)*
457 Fluidics *(II, 3)*
464 Vibrations *(II, 3)*
465 Experimental Mechanics *(I, 3)*
466 Introduction to Finite Element Methods *(II, 3)*
491, 492 Special Problems *(I and II, 1–6 each)*

501, 502 Graduate Seminar *(I and II, 1 each)* Discussions, presentation of papers based on research, or detailed literature surveys. Attendance is required of all students in graduate residence. *(Lec. 1) S/U credit.* Staff

503 Linear Control Systems
See Electrical Engineering 503.

504 Optimal Control Theory
See Electrical Engineering 504.

505 Optimization in Mechanical Engineering Design *(I or II, 3)* Unified presentation of optimization techniques pertinent to mechanical engineering, emphasizing similarity of design processes for thermal systems, mechanics, and control. Finite and infinite dimensional methods. *(Lec. 3) Pre: 366 and 423 or equivalent.* Palm and Datseris

506 Expert Systems for Mechanical Design and Manufacturing *(I, 3)* Expert systems structure; knowledge bases, inference engines, and artificial intelligence languages. Applications to mechanical design and manufacturing problems. Graph theory and expert systems for mechanism design; features for design and manufacturing. *(Lec. 3) Pre: 430 or equivalent.* Datseris or Olson

521 Reliability Analysis and Prediction *(II, 3)* Statistical analysis of failure of complex engineering systems, design factors contributing to functional system survival, failure, distribution functions, redundancy, confidence, reliability testing. *(Lec. 3) Pre: MTH 451 or equivalent, MCE 423 or permission of instructor.* Nash

523 Advanced Kinematic Analysis *(I, 3)* Centrodes, Cardanic Motion, curvature (Euler-Savary), higher curvature. Applications: plane and spherical four-bar (Universal Joint), skew four-bar. General computer programs. Intermittent mechanisms (geneva), noncircular gears, space mechanisms. *(Lec. 3) Pre: 323 or equivalent.* Datseris and Olson

524 Advanced Kinematic Synthesis *(I, 3)* Degrees of freedom, graph theory in design, applications. Position synthesis, circle-point and center-point curves. Chebyshev theorem. Direct, indirect, and numerical optimum synthesis. Constant-velocity mechanisms. Spatial mechanisms. *(Lec. 3) Pre: 523.* Datseris and Olson

540 Underwater Life Support
See Ocean Engineering 540.

541, 542 Advanced Thermodynamics I, II *(I and II, 3 each)* Advanced study of classical thermodynamics with emphasis on basic concepts, laws, and thermodynamic relationships. Selected topics of current interest including areas of irreversible thermodynamics, statistical mechanics, and the thermodynamics of solids. *(Lec. 3) Pre: 341, 342, and permission of instructor.* Brown, Wilson, and Henderson

545 Heat Transfer *(I, 3)* Conduction in two and three dimensions and conducting systems with radiation and fluid motion. Solutions obtained by mathematics, computer-numerical methods, and analog devices. *(Lec. 3) Pre: 448.* Test, Faghri, and Henderson

546 Convection Heat Transfer *(II, 3)* Relationship between heat transfer and fluid flow with emphasis on the solution of governing equations by exact methods, integral methods. and similarity techniques. *(Lec. 3) Pre: 448.* Test, White, and Faghri

549 Advanced Product Design for Manufacture
See Industrial and Manufacturing Engineering 549.

550 Theory of Continuous Media *(I, 3)* Basic course for first-year graduate students which develops and unifies the laws of mechanics as applied to the behavior of continua. Application to solids and fluids. *(Lec. 3) Pre: CVE 220, MCE 354, 372, or permission of instructor.* Sadd

551 Fluid Mechanics I *(I, 3)* Basic treatment of real fluid flows using the continuum mechanics approach. Exact solutions of the governing equations. Laminar shear flows and boundary layer theory, turbulent

transition. *(Lec. 3) Pre: 354 or equivalent.* Hagist, Lessmann, and White

552 Fluid Mechanics II *(II, 3)* Continuation of 551 including turbulent modeling, turbulent shear flows and boundary layers, incompressible irrotational flows, and selected topics such as an introduction to non-Newtonian fluid behavior, geophysical flows, or numerical methods. *(Lec. 3) Pre: 551.* Hagist, Lessmann, and White

553 Fluid Mechanics III *(I, 3)* Two- and three-dimensional compressible flows, numerical methods for the solution of compressible and incompressible parabolic and elliptic problems. Other advanced topics of current interest. *(Lec. 3) Pre: 551 or permission of instructor.* Hagist, Lessmann, and White

561 Computational Methods in Solid Mechanics *(I or II, 3)* Finite and boundary element methods based on variational and weighted residual concepts; practical implementation to field problems in elasticity, plasticity, and heat conduction. *(Lec. 3) Pre: 373 and one graduate course in elasticity or heat conduction.* Kim, Sadd, and Taggart

562 Computational Methods in Fluid Flow and Heat Transfer *(I or II, 3)* Computational techniques and applications for practical problems concerning multidimensional fluid flow, heat and mass transfer, and chemical reactions. *(Lec. 3) Pre: undergraduate work in fluid mechanics and heat transfer or permission of instructor.* Faghri

563 Advanced Dynamics *(I and II, 3)* Dynamics of a system of particles, Lagrange's equations from an advanced point of view. Variational methods, nonconservative and nonholonomic systems; matrix-tensor specifications of rigid body motions, normal coordinates. Hamilton's equation of motion, canonical transformation, Hamilton-Jacobi theory. *(Lec. 3) Pre: 463 or permission of instructor.* Datseris and Nash

564 Advanced Vibrations *(I, 3)* Theory of vibration of systems with concentrated masses and stiffness; systems with one degree of freedom, vibration isolation systems with many degrees of freedom, matrix methods, dynamic vibration absorbers, torsional vibration, approximate numerical methods. Experimental methods and design procedures. *(Lec. 3) Pre: 464.* Palm and Nash

565 Wave Motion and Vibration of Continuous Media *(II, 3)* Wave motion and vibrations of strings, rods, beams, plates, and membranes; dynamic elasticity theory; Rayleigh surface waves; solutions using separation of variables and integral transforms. *(Lec. 3) Pre: 373, 464, or equivalent.* Sadd and Shukla

566 The Mechanics of Robot Manipulators *(I or II, 3)* Detailed analysis of the kinematics, dynamics, and control of industrial-type robot manipulator systems *(Lec. 3) Pre: 323, 366, or permission of instructor.* Palm

568 Theory of Plates
See Civil Engineering 568.

571 Theory of Elasticity I *(I, 3)* Development of the basic field equations; generalized Hooke's law; general concepts of stress and strain; plane problems; stress functions; Saint Venant torsion and flexure; introduction to three-dimensional problems. *(Lec. 3) Pre: CVE 220 or equivalent.* Sadd, Ghonem, Shukla, and Taggart

572 Theory of Elasticity II *(II, 3)* Continuation of 571, including advanced topics selected from: complex variable methods; displacement potentials and stress functions for three-dimensional problems; thermoelasticity; variational, approximate, and numerical methods; anisotropic solutions. *(Lec. 3) Pre: 571 or equivalent.* Sadd and Kim

576 Fracture Mechanics *(II, 3)* Fundamentals of linear elastic fracture mechanics, stress analysis viewpoint, energy viewpoint, two-dimensional and three-dimensional problems, elastic-plastic considerations, and crack extension behaviors. *(Lec. 3) Pre: 426 or permission of instructor.* Shukla and Ghonem

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

646 (or CHE 646) Radiation Heat Transfer *(I or II, 3)* Radiant exchange between surfaces. Radiative properties of surfaces. Exchange among nonideal surfaces. Gas-radiative exchange. Radiative exchange with volume emitters. Furnace design applications. *(Lec. 3) Pre: 545 or CHE 644 or permission of instructor.* Brown and Henderson

650 (or CHE 650) Advanced Topics in Heat Transfer *(I or II, 3)* Advanced topics in heat transfer which are of current research interest. Topics may involve all modes of heat transfer and could include phase change and mass transfer. *(Lec. 3) Pre: 545, 546, or permission of instructor.* Staff

651 Turbulent Flows *(I, 3)* Turbulent flows from both the phenomenological and statistical points of view. Applications to meteorology, boundary layers, and turbulent diffusion. *(Lec. 3) Pre: 551 or permission of instructor.* Hagist

652 Experimental Methods in Fluid Mechanics *(II, 3)* An overview of measurement techniques and instrumentation used in the current practice of experimental fluid mechanics. Course emphasizes hot wire, hot film, and laser anemometry. Provides practical laboratory experience. *(Lec. 2, Lab. 3) Pre: 551 or permission of instructor.* Hagist and Lessmann

666 Nonlinear Mechanics *(I and II, 3)* Dynamics of nonlinear systems, free and forced oscillations; graphical methods, integral curves, singular points, limit cycles and stability. Van der Pol equation, perturbation methods, approximate methods, application to ecological systems. *(Lec. 3) Pre: 564.* Nash

668 (or CVE 668) Theory of Shells *(I or II, 3)* Development of basic shell equations. Classical solution examples for membrane shells and shells of revolution with bending. Additional topics selected from variational methods, finite element techniques, reinforced and composite shells. *(Lec. 3) Pre: 568 or permission of instructor.* Sadd and Karamanlidis

677 Fatigue *(II, 3)* Fracture mechanics concepts, aspects of classical fatigue, fundamental theories of microscopic crack initiation and propagation, low cycle fatigue, thermomechanical fatigue, environment-assisted and corrosion fatigue, fracture and fatigue control plans. *(Lec. 3) Pre: 426 or equivalent or permission of instructor.* Ghonem and Nash

678 Micromechanics *(II, 3)* Mechanics of material behavior from the microstructural viewpoint; mathematical modeling of inclusions, inhomogeneities, dislocations, granular and porous structures; constitutive equation development. Applications to metals, composites, ceramics, and other materials with microstructure. *(Lec. 3) Pre: 571, materials background of CHE 333 or higher.* Ghonem, Taggart, or Sadd

679 Theory of Plasticity *(II, 3)* Formulation and solution of inelastic material behavior, physical phenomena of yielding plastic flow, plastic stress-strain laws, yield criteria, plane problems, torsion, slip lines, limit analysis, creep. *(Lec. 3) Pre: 571 or permission of instructor.* Sadd and Ghonem

680 Advanced Topics in Solid Mechanics *(I or II, 3)* Advanced studies in the mechanics of solids with specific topics determined by current department interests. Designed for students with at least one year of previous graduate studies. *(Lec. 3) Pre: permission of instructor. May not be repeated.* Staff

691, 692 Special Problems *(I and II, 1–6 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Medicinal Chemistry

M.S., Ph.D. (Pharmaceutical Sciences)

Graduate Faculty

Chairperson: Professor Elie Abushanab, Ph.D., 1965, University of Wisconsin
Professor Raymond P. Panzica, Ph.D., 1972, University of Utah

Professor Charles I. Smith, Ph.D., 1950, University of Maryland
Professor Joseph G. Turcotte, Ph.D., 1967, University of Minnesota

Specializations

Research activities are focused on the design and synthesis of chemotherapeutic agents. The areas of cancer and viral chemotherapy receive the greatest attention from our faculty. Research projects include the rational development of new compounds by synthetic or microbial methods, the chemical modification of clinical agents to facilitate drug delivery to targeted sites, and the synthesis of enzyme inhibitors. Other projects focus on the synthesis of agents to combat tropical, pulmonary, and cardiovascular diseases.

Master of Science

Admission requirements: GRE and bachelor's degree in pharmacy, chemistry, biochemistry, or allied sciences.

Program requirements: thesis; A.C.S. placement examination (organic) to determine specific program requirement; CHM 431, 432, or BCP 435 or equivalent; CHM 425, 427, and 521 or 522; MCH 443, 444, or equivalent; MCH 548, 621, 622; written master's examination. All students must register for and attend a seminar each semester while in graduate residence. Each student will present one seminar per semester unless otherwise indicated by the majority of the departmental faculty.

Doctor of Philosophy (Pharmaceutical Sciences)

Admission requirements: GRE and master's degree in pharmacy, chemistry, biochemistry, or allied sciences or bachelor's degree in one of these with evidence of superior ability.

Program requirements: dissertation; A.C.S. placement examination (organic) to determine specific program requirement; same as for master's degree plus CHM 521 and 522; also MCH 501, 533, and 549 recommended; primary emphasis in organic, medicinal chemistry, and pharmaceutical analysis.

Qualifying examination is required for candidates accepted without M.S. degree.

MCH Courses
Medicinal Chemistry

443, 444 Organic Medicinal Chemistry *(I and II, 3 each)*

497, 498 Special Problems *(I and II, 1–5 each)*

501 Radiopharmaceuticals *(I, 3)* The theoretical and applied aspects of the commonly used isotopes of pharmaceutical significance with emphasis on the diagnostic, therapeutic, and tracer applications in biological systems and techniques of development, formulation, quality control, and safe utilization. *(Lec. 2, Lab. 3) Pre: CHM 228 and PHY 112 or permission of instructor.* Smith

526 Lipid Chemistry
See Food Science and Technology 526.

548 (or PCG 548) Physical Methods of Identification *(II, 3)* Utilization of physical methods (primarily spectroscopic) in the structure elucidation of complex organic molecules. Emphasis on interpretation of ultraviolet, infrared, nuclear magnetic resonance, mass, and optical rotatory dispersion spectra. *(Lec. 3) Pre: CHM 425 and/or permission of instructor.* Staff

549 Synthesis *(I and II, 3)* Theoretical and applied aspects in synthesis of selected organic compounds of medicinal significance. *(Lab. 9) Pre: permission of instructor.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

621, 622 Seminar *(I and II, 1 each)* Seminar discussions including student presentations of papers on selected topics in medicinal chemistry. *(Lec. 1) May be repeated for a maximum of 3 credits. S/U credit.* Staff

643 Advanced Organic Medicinal Chemistry *(II, 3)* Synthesis, modes of action, and effects on pharmacological activity. Analgesics, cholinergics, folic acid antagonists, diuretics, and sulfonamides are included. *(Lec. 3) Pre: CHM 522 and permission of instructor. In alternate years. Next offered 1989–90.* Staff

646 Alkaloids *(I, 3)* Advanced course dealing with proof of structure, synthesis, chemical properties, and biological activity of various alkaloids. *(Lec. 3) Pre: permission of instructor.* Abushanab

697, 698 Research in Medicinal Chemistry *(I and II, 1–3 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics in medicinal chemistry. *(Lab. 3-9) Pre: permission of instructor.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Microbiology
M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor David C. Laux, Ph.D., 1971, University of Arizona
Professor Victor J. Cabelli, Ph.D., 1951, University of California, Los Angeles
Professor Paul S. Cohen, Ph.D., 1964, Boston University
Professor Harold W. Fisher, Ph.D., 1959, University of Colorado
Professor Linda A. Hufnagel, Ph.D., 1967, University of Pennsylvania
Professor John M. Sieburth, Ph.D., 1954, University of Minnesota
Professor Richard W. Traxler, Ph.D., 1958, University of Texas
Professor Norris P. Wood, Ph.D., 1955, University of Pennsylvania
Associate Professor David R. Nelson, Ph.D., 1979, University of California, Los Angeles
Associate Professor Jay F. Sperry, Ph.D., 1974, University of Kansas
Assistant Professor Joanna F. Norris, Ph.D., 1982, Michigan State University
Adjunct Assistant Professor Scott R. Rippey, Ph.D., 1979, The University of Rhode Island
Adjunct Assistant Professor William D. Watkins, Ph.D., 1979, The University of Rhode Island

Specializations

Medical microbiology: pathogenesis, immunology, mycology, virology.

Microbial genetics, physiology, molecular microbiology: genetic and molecular relation of cellular morphogenesis and development, bacterial colonization of the mammalian intestine, messenger RNA metabolism in procaryotes and eucaryotes, virus multiplication, control of transport and metabolism, mechanisms of survival, membrane structure.

Cell biology, cellular development, ultrastructure: ciliogenesis in protozoa, electron microscopy, ultrastructure of electrically conducting systems, cell culture, cellular immunity.

Microbial ecology, industrial microbiology, pollution: marine and freshwater microbial ecology, biodeterioration, sanitary bacteriology, coliform ecology.

Master of Science

Admission requirements: GRE and two semesters each of introductory courses in biology (zoology, botany), inorganic and organic chemistry, mathematics, and physics; a semester each of microbiology, genetics, quantitative analysis, and biochemistry.

Program requirements: thesis; BCP 581; MIC 413, 414, 415, 416, 599, 695, and 696; major portion of courses in microbiology, including one from an area other than bacteriology (virology, mycology, phycology, cell biology, protozoology); written comprehensive examination.

Doctor of Philosophy (Biological Sciences)

Admission requirements: same as for master's degree and two semesters of calculus, BCP 435, and statistics. Proficiency in one foreign language may be required by the student's major professor. Master's degree normally required; outstanding candidates may be accepted without an M.S. degree.

Program requirements: same as for master's degree plus BCP 582; MIC 533, 552, and dissertation. A course in microbial physiology (MIC 641, BOT 534, OCG 663 or equivalent). Of the credits earned beyond the master's degree, 18 should be in coursework. Qualifying examination is required. Prior to the last semester, the candidate must pass a written and oral comprehensive examination in the major areas of microbiology.

MIC Courses
Microbiology

401 (or BCP 401) Quantitative Cell Culture *(I, 3)*
403 (or BCP 403) Introduction to Electron Microscopy *(I, 2)*
405 (or BCP 405) Electron Microscopy Laboratory *(I, 2)*
410 Molecular Genetics of the Protozoa *(II, 3)*
412 Food Microbiology *(II, 3)*
413 Advanced Microbiology Lecture I *(I, 3)*
414 Advanced Microbiology Lecture II *(II, 3)*
415 Advanced Microbiology Laboratory I *(I, 2)*
416 Advanced Microbiology Laboratory II *(II, 2)*
421 (or BCP 421) Cell Biology and Cancer *(I, 3)*
422 (or FSN 422) Industrial Microbiology *(II, 3)*
432 Pathogenic Bacteriology *(II, 3)*
453 (or BOT 453) Cell Biology *(II, 3)*
483 (or MTC 483) Introductory Diagnostic Microbiology *(I, 3)*
495, 496 Seminar in Microbiology *(I and II, 1 each)*

501 Advanced Clinical Microbiology I
See Medical Technology 501.

502 Techniques in Microbial and Molecular Genetics *(II, 2)* Techniques for the study of molecular genetics in bacteria and bacteriophages including mutant isolation, phage growth, transformation, transduction, conjugation, DNA isolation and analysis, and gene cloning. *(Lab. 6) Pre: 413 and 415 or BOT 437 or BOT 454 or BOT 522 or permission of instructor.* Nelson or Cohen

503 (or BCP 503) Electron Microscopy *(I, 2)* Biological specimen preparation techniques for transmission and scanning electron microscopy. Includes thin sectioning, negative staining, shadow-casting, freeze-etching, cytochemistry, principles of electron microscope operation. Final written and oral reports. *(Lec. 2) Pre: one year of science and permission of instructor. Not open to students with credit in 403.* Hufnagel

505 (or BCP 505) Laboratory in Electron Microscopy *(I, 3)* Introduction to biological sample preparation for transmission and scanning electron microscopy. Tissue preparation, ultramicrotomy, operation of the electron microscope, darkroom procedures, particulate and molecular sample preparation, critical point drying, sputtercoating. Not open to students who have taken 405. *(Lab. 6) Pre: credit or concurrent enrollment in 403 or 503 and permission of instructor.* Hufnagel

510 (or ZOO 510) Cell and Developmental Biology of the Ciliated Protozoa *(II, 2)* Ciliates as model systems for analysis of eucaryotic cell development. Emphasis on experimental methods, including microscopy (Brightfield, phase contrast, Normarski, fluorescence); histochemistry; organelle isolation; protein analysis; genetics; cell synchronization; inhibitors. *(Lab. 4) Pre: MIC 413 or equivalent or permission of instructor. In alternate years. Next offered spring 1991.* Hufnagel

513 Advanced Clinical Immunology
See Medical Technology 513.

514 The Electron Microscope in Molecular and Cellular Biology *(II, 2)* Use of the electron microscope to analyze structure and function of biological molecules. Applications in food science, pathology, pharmacology, ecology, gene engineering, and basic research. *(Lec. 2) Pre: BCP 311 and BOT 352 or permission of instructor. In alternate years. Next offered spring 1990.* Hufnagel

515 Infectious Diseases
See Medical Technology 515.

521 (or BOT 521 or ZOO 521) Recent Advances in Cell Biology *(I, 2)* Reading of current papers in the area of cell biology and preparation of written and oral reports. Emphasis on animal cells. *(Lec. 2) Pre: at least one of the following courses or an equivalent course emphasizing cell structure and function—ZOO 315, 441, BOT 432, 445, 453, and MIC 408; graduate standing or permission of instructor. May be repeated for a maximum of 4 credits.* Hufnagel

523 (or FSN 523) Water Pollution Microbiology *(I, 3)* The microbiological aspects of water pollution, including the potential for infectious diseases, pollution effects on microbial ecosystems, and the microbial degradation of pollutants. *(Lec. 3) Pre: 201 or 211, BCP 311, or permission of instructor. Credit or concurrent enrollment in 525.* Cabelli and Traxler

525 (or FSN 525) Water Pollution Microbiology Laboratory *(I, 1)* Experimental method for pollution analysis, microbial indicator assay methods, microbial assays, sample collection and statistical treatment of data. *(Lab. 3) Pre: concurrent enrollment in 523 or permission of instructor.* Cabelli

533 Immunology *(II, 3)* Introduction to the cellular, molecular, and genetic basis of the immune system, and the role of the immune system in immunity to infection, tumor and transplantation immunobiology, and immunopathology. *(Lec. 3) Pre: 201 or 211.* Laux

534 Animal Virology
See Aquacultural Science and Pathology 534.

536 Virology Laboratory
See Aquacultural Science and Pathology 536.

538 Epidemiology of Viral and Rickettsial Diseases
See Aquacultural Science and Pathology 538.

541 Advanced Clinical Microbiology II
See Medical Technology 541.

552 Microbial Genetics *(II, 3)* Recent research on the mechanism of mutation, genetic recombination, the genetic code, transposons, regulations, genetic engineering and regulation of DNA, RNA, and protein synthesis in microsystems. *(Lec. 3) Pre: 201, BOT 352, and BCP 311.* Cohen

561 Recent Advances in Molecular Cloning *(I or II, 1)* Reports of readings concerning the latest developments in techniques of molecular cloning and their applications in the study of various biological systems. *(Lec. 1) Pre: 552 or permission of instructor. May be repeated.* Nelson

576 Marine Microbiology
See Oceanography 576.

593, 594 The Literature of Bacteriology *(I and II, 1 each)* Thorough study of original literature of some phase of bacteriology. Written abstracts or papers on assigned topics are discussed in weekly conferences with instructor. *(Lec. 1–2)* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

622 (or BCP 622) Advanced Electron Microscopy *(II, 2)* The physical functioning of electron microscopes; high resolution microscopy of macromolecules; newly available EM histochemical procedures; and computer processing of electron images. *(Lec. 2) Pre: 403, 405, or permission of chairperson.* Hufnagel

624 (or BCP 624) Advanced Electron Microscopy Laboratory *(II, 2)* Cleaning and aligning the electron microscope; development of independent project utilizing advanced techniques, and formal presentation of results of individual projects to the class. *(Lab. 6) Pre: credit or concurrent enrollment in 622 or permission of chairperson.* Hufnagel

641 Physiology of Bacteria *(II, 3)* Bacterial structure and function, including growth, nutrition, environmental factors, metabolism, biosynthesis, and energy-yielding reactions. *(Lec. 3) Pre: 413 and 415. In alternate years. Next offered 1989–90.* Wood

654 Advances in Immunology *(II, 2)* Reports on assigned readings concerning latest developments in the field of cellular and humoral immunity presented and discussed by students. Research paper and critical review of a scientific paper required. *(Lec. 2) Pre: 553, BCP 311, or permission of*

instructor. May be repeated for a maximum of 4 credits. In alternate years. Next offered 1989–90. Laux

656 Mechanisms of Bacterial Pathogenesis *(I, 3)* Study of recent research on the molecular mechanisms of pathogenesis. Students expected to participate in roundtable discussions of recent pertinent literature. *(Lec. 3) Pre: 432, 552, and BCP 311. In alternate years. Next offered 1990–91.* Staff

691, 692 Special Problems in Microbiology *(I and II, 3 each)* Assigned research on an advanced level. Student required to outline problem, conduct the necessary literature and experimental work, and present observations and conclusions in a report. *(Lab. 6) Pre: graduate standing.* Staff

695, 696 Graduate Research Seminar *(I and II, 1 each)* Reports of research in progress or completed. *(Lec. 1) Required of all graduate students in microbiology. S/U credit.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

930 Workshop in Microbiology Topics for Teachers *(I and II, 0–3 each)* Especially designed for teachers of biology. Basic topics of microbiology from an advanced or pedagogical perspective. *(Lec. or Lab.)* Staff

Note: For Virology, see Aquacultural Science and Pathology and Plant Sciences. For Mycology, see Botany.

Music
M.M.

Graduate Faculty

Chairperson: Professor Kenneth Keeling, D.M.A., 1972, Catholic University of America
Coordinator of Graduate Studies: Professor Geoffrey D. Gibbs, D.M.A., 1974, Eastman School of Music, University of Rochester
Professor Joseph S. Ceo, D.M.A., 1976, Catholic University of America
Professor John D. Dempsey, M.M., 1964, Eastman School of Music, University of Rochester
Professor Henry C. Fuchs, M.Mus., 1961, University of Michigan
Professor George E. Kent, M.M., 1960, New England Conservatory of Music
Professor Gene J. Pollart, M.M., 1967, University of Colorado
Professor W. Donald Rankin, D.M.A., 1970, Boston University
Associate Professor James Ladewig, Ph.D., 1978, University of California, Berkeley

Specializations

Performance or music education.

Master of Music

Admission requirements: undergraduate major, or the equivalent, in music with a grade point average of 2.50 or above; GRE with advanced test in music. Applicants for performance as a specialization, or for the performance/essay subspecialization under music education, must pass an audition in their major performance subject before acceptance into a program.

Program requirements: postadmission placement examinations in music history, literature, and theory determine whether background deficiencies must be made up for no program credit. A placement examination is also required of music education students. A minimum of 30 credits is required for graduation. One-half of the program credits must be at the 500 level. (Teacher certification requires additional courses in education at the undergraduate level.)*Performance specialization:* 12 credits in MUS 561 plus MUS 548, 565, 567, and 4 credits distributed according to the major performance subject, as follows. *For vocalists—2* credits in 485 or 598, music elective. *For pianists—2* credits in 590 or 598, music elective. *For organists and guitarists*—2 credits in 598, music elective. *For other instrumentalists*—MUS 512 and ensemble elective. All performance candidates must also take a minimum of 9 credits of electives from music history/literature and theory/composition (no more than 6 credits in any one of these two areas), and pass a written comprehensive examination.

Music education specialization: MUS 537, 540, 545, 548, and 9 credits in performance/essay—MUS 551 (6 credits), 555, and 570; thesis—6 credits in MUS 599 and 3 elective credits. All music education candidates must also take a minimum of 9 credits of electives from music history/literature, theory/composition, and performance (no more than 6 credits in any one of these three areas, and performance only if it is not already part of the specialization.) Students in a thesis program must pass a written qualifying examination before thesis work is begun and a final oral examination. All other music education candidates must pass a written comprehensive examination.

MUS Courses
Music

407 The Symphony *(II, 3)*
408 The Opera *(II, 3)*
418 Composition *(II, 3)*
419 Composition *(I, 2)*
420 Counterpoint *(II, 3)*
422 Advanced Orchestration *(II, 2)*
423 Sixteenth-Century Counterpoint *(II, 3)*
430 The Renaissance Period *(I, 3)*
431 The Baroque Era *(I, 3)*
432 The Classical Era *(II, 3)*
433 The Romantic Era *(I, 3)*
434 The Modern Era *(I, 3)*
438 Topics in Elementary School Music *(I, 3)*
441 Special Projects *(I and II, 3)*
442 Directed Study in Applied Music Pedagogy *(I and II, 2)*
451 Performance as Minor *(I and II, 2)*
481, 482 Piano Literature and Pedagogy *(I and II, 2 each)*
483, 484 Vocal Literature and Pedagogy *(I and II, 2 each)*
485 Opera Workshop *(I and II, 1)*

512 Advanced Instrumental Conducting *(I, 2)* Critical study of orchestral and chamber music scores with reference to interpretation and performance. Development of technical command and expressive skill includes supervised rehearsal and conducting of university ensembles. *(Lec. 2) Pre: knowledge of basic baton as evidenced in audition or credit in 312. In alternate years. Next offered fall 1989.* Ceo

537 Musical Thought and Expression *(I, 3)* Selected major readings from philosophical foundations of music, including aesthetics and psychology. Intensive study and projects related to musical performance practices. *(Lec. 3) Pre: graduate standing in music. In alternate years. Next offered fall 1989.* Staff

540 Advanced Principles of Music Education *(II, 3)* Critical study of principles of objectives, program, method, administration, supervision, and evaluation of music education in the United States. *(Lec. 3) In alternate years. Next offered spring 1990.* Staff

545 Musical Aptitude and Achievement *(I, 3)* Intensive analysis of musical aptitude and achievement, from a thorough examination of existing devices to the consequent realization of research data via basic statistical concepts. *(Lec. 3) Pre: graduate standing in music, EDC 371 or PSY 434 or equivalent. In alternate years. Next offered fall 1990.* Staff

548 Research in Music *(II, 3)* Examination of research techniques as applied to the art of music. Extant major project procedures and data in the research categories: historical, analytical, experimental, descriptive, and philosophical. *(Lec. 3) Pre: 545 or permission of chairperson. In alternate years. Next offered spring 1991.* Staff

551 Performance as Minor or Elective *(I and II, 2)* Private instruction. One 60-minute lesson and scheduled practice hours each week.* One level, one year as prescribed in performance minor syllabi. Afternoon recital required each semester. *(Studio 6) Pre: completion of performance minor in undergraduate upper division and permission of chairperson. May be repeated.* Staff

Select area of instruction from the follow-

* See page 19 for applied music fee associated with this course.

ing, and add to course number as MUS 551B Piano:

A Voice	I Viola d'Amore	R Trombone
B Piano	J Flute	S Baritone Horn
C Organ	K Oboe	T Tuba
D Harpsichord	L Clarinet	U Percussion
E Violin	M Bassoon	V Guitar
F Viola	N Saxophone	W Harp
G Violoncello	P Trumpet	
H Bass Viol	Q French Horn	

555 Graduate Recital for Performance Minor *(I and II, 0)* Performance of advanced repertoire of various styles in a public program of at least 45 minutes performance time after faculty acceptance. *Pre: concurrent enrollment in 551 and 4 or more credits in 551.* Staff

561 Performance Major *(I or II, 3, 4, or 6)* Private instruction for graduate performance majors only. One 60-minute lesson each week.* Recital performance as required by department and instructor. See 551 for areas of instruction. *(Studio 60 minutes) Pre: audition demonstrating proficiency and comprehension equivalent to that required for the completion of the B.Mus. in performance. May be repeated.* Staff

565 Graduate Recital for Performance Major *(I and II, 0)* Performance of advanced repertoire of various styles in a public program of at least 55 minutes performing time after faculty acceptance. *Pre: concurrent enrollment in 561 and 6 or more credits in 561.* Staff

567 Seminar in Performance and Pedagogy *(II, 2)* Study of performance literature, practice, and pedagogy. Research projects and supervised teaching experience appropriate to the major performance area. *(Lec. 2) Pre: concurrent enrollment in 551 or 561. In alternate years. Next offered spring 1990.* Gibbs

570 Graduate Project *(I and II, 3)* Independent study resulting in a major essay, composition, or orchestration. *Pre: 548 and permission of chairperson.* Staff

590 Piano Accompanying *(I and II, 1)* Development of sightreading skills. Preparation and performance of accompaniments of major works. *(Lec. 1) Pre: permission of piano faculty. May be repeated for a maximum of 3 credits.* Rankin

591 University Symphony Orchestra *(I and II, 1) (Lec. 3) Pre: audition at graduate level of performance. May be repeated.* Ceo

593 University Chorus *(I and II, 1) (Rehearsal 3) Pre: audition at graduate level of performance. May be repeated.* Kent

594 Symphonic Wind Ensemble *(I and II, 1) (Lec. 3) Pre: audition at graduate level of performance.* Pollart

595 Concert Choir *(I and II, 1) (Lec. 3) Pre: audition at graduate level of performance.* Kent

596 Jazz and Studio Ensemble *(I and II, 1)* Study and performance of jazz and studio music, with leadership roles in improvisation and sectional rehearsals and performance. Demonstration of technical and stylistic competencies for these roles in audition. *(Lab. 3)* Staff

597 University Chamber Orchestra *(I and II, 1)* An ensemble which offers the study and performance of standard and modern repertoire for the smaller orchestral group. Literature will be selected from the Baroque, Rococo, Classic, and contemporary periods. *(Rehearsal 3) Pre: audition at graduate level of performance. May be repeated.* Ceo

598 Chamber Music Ensemble *(I and II, 1)* Chamber music ensembles are designated as

A Keyboard Ensemble	B String Ensemble
C Woodwind Ensemble	D Brass Ensemble
E Percussion Ensemble	G Madrigal Singers
H Guitar Ensemble	M Jazz Combo

Select appropriate letter and small ensemble from the list and add to course number, as 598B String Ensemble. Other ensemble combinations may be added. Small instrumental ensembles are normally restricted to one performer per part *(Lec. 2) Pre: graduate standing in music and evidence by audition of graduate-level performance. May be repeated.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *Pre: 548. May be repeated. S/U credit.* Staff

Natural Resources

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor William R. Wright, Ph.D., 1972, University of Maryland
Professor James H. Brown, Jr., D.F., 1965, Duke University
Professor Earl F. Patric, Ph.D., 1958, New York State University College of Forestry, Syracuse University
Associate Research Professor Peter August, Ph.D., 1981, Boston University
Associate Professor Arthur J. Gold, Ph.D., 1983, Michigan State University
Associate Professor Francis C. Golet, Ph.D., 1973, University of Massachusetts
Associate Professor Thomas P. Husband, Ph.D., 1977, Michigan State University
Associate Professor Charles G. McKiel, M.S., 1959, University of Maine
Assistant Professor William R. Eddleman, Ph.D., 1983, Oklahoma State University
Assistant Professor Peter M. Groffman, Ph.D., 1984, University of Georgia
Adjunct Associate Professor Stephen Olsen, M.S., 1970, The University of Rhode Island

Specializations

Soil chemistry, soil biochemistry, soil genesis and classification, soil fertility and management, soil properties and land use, organic geochemistry, water resources management, avian and mammalian geology, wetland ecology, forest science, wildlife habitat analysis, wildlife management.

Master of Science

Admission requirements: GRE and bachelor's degree with undergraduate major in biological or physical sciences. Applicants with course deficiencies may be required to take appropriate undergraduate courses in the basic sciences without program credit.

Program requirements: thesis option—thesis and 24 credits including NRS 500. Nonthesis option—permission of chairperson, 36 credits with a minimum of 14 credits in natural resources science to include NRS 500 and 591, 3 credits in statistics, and a written master's examination. NRS 591 will require a substantial paper involving significant independent research. Additional prerequisite courses in the basic sciences may be required prior to admission to a degree program.

Doctor of Philosophy (Biological Sciences)

Limited to soil science and organic geochemistry specializations.

Admission requirements: GRE and M.S. degree with thesis in biological or physical science.

Program requirements: dissertation and advanced courses determined in consultation with the candidate's committee.

NRS Courses
Natural Resources Science

401 Forested Watershed Hydrology *(II, 3)*
402 Wildlife Biometrics *(II, 3)*
406 (306) Wetland Wildlife Management *(II, 3)*
410 GIS Methods in Environmental Management *(I, 3)*
423 Wetland Ecology *(I, 4)*
424 Wetlands and Land Use *(II, 3)*
450 Soil Conservation and Land Use *(II, 3)*
451 Soil and Water Conservation Technology *(I, 3)*
461 Water Resource Management *(I, 4)*
471 Soil Morphology and Mapping *(I, 2)*
475 (or PLS 475) Plant Nutrition and Soil Fertility *(II, 4)*
484 Structures *(II, 3)*
491, 492 Special Projects *(I and II, 1–3 each)*

500 Graduate Seminar in Natural Resources *(II, 1)* Presentation of research reports and discussion of current topics in

* See p. 19 for applied music fee associated with this course.

natural resources. Critique of research methodology and scientific literature. *(Lec. 1) Pre: graduate standing. Attendance is required of all resident graduate students, but no more than two credits may be taken for program credits. S/U credit.* Staff

510 Soil–Water Relations *(II, 3)* Processes governing water flow and availability in unsaturated and saturated soil. Emphasis on soil-water-plant relationships with applications to watershed management and hydrology. *(Lec. 2, Lab. 3) Pre: 212, 461, or permission of instructor.* Gold

512 Chemistry of Soils and Sediments *(II, 4)* Discussion of inorganic and organic compounds and their reaction in soils. Role of mineral and biochemical cycles in soil productivity. Modern techniques of laboratory experimentation and analysis. *(Lec. 3, Lab. 3) Pre: 212, 213, CHM 212 and 227 or permission of instructor.* Staff

524 Wetland Mapping and Evaluation *(II, 3)* Identification, delineation, and classification of wetlands on aerial photographs. Wetland map preparation, wetland evaluation, and compilation and interpretation of inventory and evaluation data using a team approach. Independent field work. *(Lec. 1, Lab. 4) Pre: 423. In alternate years. Next offered 1990–91.* Golet

567 Soil Genesis and Classification *(II, 3)* Development of soils as influenced by physical, chemical, biological, and climatic factors. Processes of soil formation presented relative to soil taxonomy and geographic distribution. *(Lec. 3) Pre: 471 or permission of instructor. In alternate years. Next offered 1990–91.* Wright

568 Recent Advances in Natural Resources Science *(I, 3)* Critical analysis and presentation of technical reports on recent advances in natural resources science. Topics will vary according to instructor and background of students. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years. Next offered 1989–90.* Staff

591, 592 Special Problems *(I and II, 1–3 each)* Advanced independent research projects supervised by members of the research staff and unrelated to thesis research. Projects developed to meet individual needs. *Pre: permission of chairperson.* Staff

599 Master's Thesis Research I, II *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

699 Doctoral Dissertation Research I, II *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Nursing

M.S., Ph.D.

Graduate Faculty

Dean: Professor Jean Miller, R.N., Ph.D., 1975, University of Washington
Assistant Dean: Assistant Professor Dayle Hunt Joseph, R.N., Ed.D., 1982, Boston University
Professor Margaret Hardy, R.N., Ph.D., 1971, University of Washington
Professor Janet I. Hirsch, R.N., Ed.D., 1978, Boston University
Professor Hesook S. Kim, R.N., Ph.D., 1977, Brown University
Associate Professor Concepcion Y. Castro, R.N., Ed.D., 1984, Boston University
Associate Professor Meredith Censullo, R.N., Ph.D., 1984, Boston College
Associate Professor Jacqueline D. Fortin, R.N., Ph.D., 1984, Boston University
Associate Professor Marion Garey, R.N., Ed.D., 1985, Boston University
Associate Professor Margaret McGrath, R.N., D.N.Sc., 1988, Boston University
Associate Professor Donna Schwartz-Barcott, R.N., Ph.D., 1978, University of North Carolina
Assistant Professor Christine Bridges, R.N., D.N.Sc., 1987, Boston University
Assistant Professor Patricia M. Burbank, R.N., D.N.Sc., 1988, Boston University
Clinical Assistant Professor Denise Fimbel-Coppa, R.N., M.S., 1982, University of Colorado
Assistant Professor Margaret Wacker, R.N., Ph.D., 1987, New York University
Professor Emerita Barbara L. Tate, R.N., Ed.D., 1961, Teachers College, Columbia University

Specializations

For the M.S.: education, administration, mental health care, primary health care, and clinical practice (with emphasis on critical care, gerontological nursing, or parent–child health nursing).

For the Ph.D.: clinical nursing research in the domains of client, client–nurse interactions, and nursing practice.

Master of Science

Admission requirements: MAT or GRE, a bachelor's degree from an NLN-accredited program with an upper-division major in nursing and an undergraduate course in statistics. For specialization in primary health care—two years of professional nursing practice. Students who have not completed upper-division undergraduate nursing coursework will be required to make up this deficiency prior to admission.

Program requirements: 36 credits for education, administration, mental health, and clinical practice specialization; 40 credits for primary health care specialization, including NUR 501, 502, 505, 510; 12–15 credits in the area of specialization (NUR 521, 522, 541, 542 for education; NUR 521, 522, 551, 552 for administration; NUR 511, 512, 513, 514 for mental health care; NUR 503, 504, 531, 532, 533, 534 for primary health care; and NUR 521, 522, 561, and 562 or 563 or 564 for clinical practice); 3 credits in physiological sciences, 3 credits in social/behavioral sciences, 3 credits related to the area of specialization (except for primary health care), and 3 credits of free electives; major paper involving independent research; written comprehensive examination.

Doctor of Philosophy

Admission requirements: GRE (scores at 60th percentile or above are desirable); a bachelor's degree from an NLN-accredited program or its equivalent in nursing, and a master's degree in nursing or its equivalent (cumulative averages of 3.00 and 3.30 respectively are desirable); two scholarly papers (one theoretical and one empirical) or a master's thesis or equivalent; three recommendations for doctoral study including one by a doctorally prepared person; a statement of purpose indicating goals congruent with those of the program and institution; and a course in statistics including inferential statistics.

Program requirements: a minimum of 61 credits including core courses in nursing (19 credits) and cognates (6 credits); electives in nursing (6 credits) and research methods (6 credits); free electives (6 credits); and the doctoral dissertation (at least 18 credits), plus written and oral comprehensive exams in nursing theory, research methods, and one substantive area. Reading comprehension of a foreign language by the time the core courses are completed is required. This requirement may be waived for those students for whom another research tool would prove more relevant to the area of research.

NUR Courses
Nursing

501 Theoretical Study of Phenomena in Nursing *(I, 3)* Major theories and concepts in nursing. Emphasis on the theoretical study of nursing phenomena commonly found in client and client-nurse systems. *(Lec. 3) Pre: graduate standing and concurrent enrollment in 502.* Bridges and Censullo

502 Practicum in the Study of Phenomena in Nursing *(I, 3)* Field study of selected nursing phenomena in health care agencies. Emphasis on the clinical application of selected theoretical or conceptual frameworks. *(Lab. 6) Pre: graduate standing and concurrent enrollment in 501.* Bridges and Censullo

503 (495) Expanded Nursing Assessment Skills *(I and II, 3)* Expansion of nursing assessment skills including health history taking and physical, psychological, and

social assessment skills. Specific physical assessment skills included are inspection, auscultation, percussion, and palpation. *(Lec. 2, Lab. 3) Pre: graduate standing or permission of instructor.* Castro or Fimbel-Coppa

504 (496) Expanded Nursing Assessment Skills: Pediatrics *(I and II, 1)* Application of expanded nursing assessment skills to children. Includes assessment of growth and development, psychosocial, cognitive, and physical well-being of children of all age groups. *Pre: 503 or permission of instructor.* Fimbel-Coppa or McGrath

505 Nursing Research *(I or II, 3)* An overview and analysis of current research in nursing with special focus on patient care. Students will design a research project. *(Lec. 3) Pre: a course in statistics, credit or concurrent enrollment in 501, 502, or permission of instructor.* Fortin

506 Independent Study in Nursing *(I and II, 2–6)* Intensive study of a specific area of interest, a problem or issue in nursing under guidance of the faculty. *Pre: permission of graduate faculty.* Staff

510 Advanced Leadership and Nursing Role Development *(I or II, 3)* Factors at various levels of social institutions that influence client and client-nurse systems. Emphasis on role development, leadership, and change in effecting patient care. *(Lec. 3) Pre: 501 and 502.* Kim and Hirsch

511 Advanced Mental Health Nursing I *(II, 3)* Investigation of theories of healthy and psychopathological patterns of individual behavior from a mental health perspective. *(Lec. 3) Pre: 501 and 502, graduate course in psychoneurology or psychobiology, and credit or concurrent enrollment in 512.* Garey

512 Practicum in Advanced Mental Health Nursing I *(II, 3)* Field experience to develop competence in the practice of advanced mental health nursing. Emphasis on application of relevant theories in solving individuals' mental health problems. *(Lab. 6) Pre: 501 and 502, graduate course in psychoneurology, and concurrent enrollment in 511.* Garey

513 Advanced Mental Health Nursing II *(I, 2)* Theoretical analysis of current modes of advanced mental health intervention in order to explain strategies for solution of family, group, and community problems. *(Lec. 2) Pre: 511, 512, and concurrent enrollment in 514.* Garey

514 Practicum in Advanced Mental Health Nursing II *(I, 4)* Field experience to develop increased competence in the practice of mental health nursing intervention. *(Lab. 8) Pre: 511, 512, and concurrent enrollment in 513.* Garey

521 Theoretical Study of Major Problems in Nursing Practice *(II, 3)* Major theories and concepts for developing strategies in nursing practice. Emphasis on developing nursing strategies through theoretical analysis of problems viewed in the context of organizational and societal systems. *(Lec. 3) Pre: 501, 502 and 505, and concurrent enrollment in 522.* Bridges and Schwartz-Barcott

522 Practicum in the Study of Major Problems in Nursing Practice *(II, 3)* Field study of major nursing problems with emphasis on examination, evaluation, and revision of nursing strategies for problems in the context of organizational and societal systems. *(Lab. 6) Pre: 501, 502 and 505, and concurrent enrollment in 521.* Bridges and Schwartz-Barcott

531 Primary Health Care Nursing I *(II, 3)* Theoretical knowledge and skills for the development of nursing strategies in analyzing, managing, and preventing health-related problems common to primary health care clients. *(Lec. 3) Pre: 500, 501, 502, and ZOO 442.* Castro and Fimbel-Coppa

532 Practicum in Primary Health Care Nursing I *(II, 3)* Clinical application of theoretical knowledge and skills as presented in 531. *(Lab. 6) Pre: concurrent enrollment in 531.* Castro and Fimbel-Coppa

533 Primary Health Care Nursing II *(I, 3)* Theoretical study for the development of increased nursing competency in primary care practice. Emphasis on health care strategies to assist individuals and families in coping with health-related problems. *(Lec. 3) Pre: 531, 532, and concurrent enrollment in 534.* Castro and Fimbel-Coppa

534 Practicum in Primary Health Care Nursing II *(I, 6)* Application of theoretical knowledge skills for the development of nursing strategies for health promotion and management of health-related problems common to families. *(Lab. 12) Pre: 531, 532, and concurrent enrollment in 533.* Castro and Fimbel-Coppa

541 Theoretical Study of Nursing Education *(I, 3)* Investigation of theories, concepts, and models applicable to nursing education. Emphasis on theoretical analysis to develop and explain strategies for the teaching of nursing. *(Lec. 3) Pre: 521, 522, permission of instructor, and concurrent enrollment in 542. In alternate years. Next offered 1989–90.* Hirsch

542 Practicum in Nursing Education *(I, 3)* Field experience in nursing education. Emphasis on the instructional design and the development of strategies for the teaching of nursing based on theoretical knowledge. *(Lab. 6) Pre: 521, 522, or permission of instructor, and concurrent enrollment in 541. In alternate years. Next offered 1989–90.* Hirsch

551 Theoretical Study of Nursing Administration *(I, 3)* Study of theories of organization and management as they relate to nursing administration. Emphasis on theories to develop or explain management strategies in nursing administration. *(Lec. 3) Pre: 521, 522, or permission of instructor, and concurrent enrollment in 552. In alternate years. Next offered 1989–90.* Staff

552 Practicum in Nursing Administration *(I, 3)* Field experience in nursing administration. Emphasis on the examination, development and implementation of strategies in nursing administration. *(Lab. 6) Pre: 521, 522, or permission of instructor, and concurrent enrollment in 551. In alternate years. Next offered 1989–90.* Staff

560 Ethical Theories, Nursing Practice, and Health Care *(I or II, 3)* Analysis of philosophic positions, ethical theories, and moral principles important to professional nurses in their clinical, educative, and administrative practice. *(Sem. 3) Pre: B.S. or B.A. in a health-related field, one course in philosophy and ethics, or permission of instructor.* Staff

561 Theories of Practice for Clinical Nursing *(I, 3)* Intensive analysis of theories of practice as applied to clinical nursing. Emphasis on theoretical knowledge of the nurse system phenomena in professional clinical nursing. *(Lec. 3) Pre: 501, 502, 521, and 522, and concurrent enrollment in 562, 563, or 564. In alternate years. Next offered 1990–91.* Hirsch

562 Advanced Clinical Study of Nursing Practice in Critical Care *(I, 3)* Field study in critical care nursing. Emphasis on testing and evaluating selected theories of practice as applied to critical care nursing. *(Lab. 6) Pre: 501, 502, 521, and 522, and concurrent enrollment in 561. In alternate years. Next offered 1990–91.* Fortin

563 Advanced Clinical Study of Nursing Practice in Gerontology *(I, 3)* Field study in gerontological nursing. Emphasis on testing and evaluating selected theories of practice as applied to gerontological nursing. *(Lab. 6) Pre: 501, 502, 521, and 522, and concurrent enrollment in 561. In alternate years. Next offered 1990–91.* Burbank

564 Advanced Clinical Study of Nursing Practice in Parent–Child Health *(I, 3)* Field study in parent–child health nursing. Emphasis on testing and evaluating selected theories of practice as applied to parent–child health nursing. *(Lab. 6) Pre: 501, 502, 521, 522, and concurrent enrollment in 561. In alternate years. Next offered 1990–91.* Hirsch

601 Foundations of Nursing Science *(I, 3)* Analysis of the nature of nursing knowledge from the historical and epistemological perspectives. Focus on examination of theoretical, ethical, and methodological foundations of the development of nursing science. *(Lec. 3) Pre: doctoral standing in nursing.* Hardy

602 Construction of Nursing Theory I: Inductive Process *(II, 4)* Study of inductive approaches to generating theory relevant to nursing science. Examination of multidisciplinary strategies for generation of theory from field data. *(Lec. 2, Lab. 4) Pre: doctoral standing in nursing, 601, or permission of instructor.* Schwartz-Barcott

603 Construction of Nursing Theory II: Deductive Process *(I, 3)* Study of deductive theory-building as applied to nursing science. Focus on the nature of deductive theories and the application of deductive process to nursing theory construction. *(Lec. 3) Pre: doctoral standing in nursing, 601, or permission of instructor.* Kim

621 Nursing Theory and Research in the Client Domain *(I, 3)* In-depth, comparative analysis of existing nursing theories and research relevant to the client domain. Development of a research proposal for validation of a selected nursing theory. *(Lec. 3) Pre: doctoral standing in nursing and completion of core courses in nursing.* Schwartz-Barcott

631 Nursing Theory and Research in the Client–Nurse Domain *(I or II, 3)* Study of theoretical and research work in the client–nurse domain. Formulation and testing of hypotheses dealing with client–nurse phenomena. *(Lec. 2, Lab. 2) Pre: doctoral standing in nursing and completion of core courses in nursing.* Hardy

641 Nursing Theory and Research in the Practice Domain *(I or II, 3)* In-depth analysis of theoretical and research work in the nursing domain of practice. The expansion and refinement of knowledge for nurse-system phenomena of the practice domain. *(Lec. 3) Pre: doctoral standing in nursing and completion of core courses in nursing.* Kim

651 Advanced Methods in Nursing Research I *(I, 3)* In-depth study of theories and methods in sampling, research design, data collection, and data analysis, and their application to qualitative research in nursing. Emphasis on qualitative data collection methods. *(Lec. 3) Pre: doctoral standing in nursing, advanced statistics course, or permission of instructor.* Fortin

652 Advanced Methods in Nursing Research II *(II, 3)* In-depth study of application of theories and methods in sampling, research design, data collection, data analysis for quantitative and evaluative research in nursing. *(Lec. 3) Pre: doctoral standing in nursing, 651, or permission on instructor.* Fortin

654 Ethnographic Approaches in Health and Nursing Research *(I or II, 3)* Examination of various ethnographic approaches that have emerged from anthropological fieldwork and their current and potential application in health and nursing research. *(Lec. 3) Pre: 651 or permission of instructor.* Schwartz-Barcott

660 Philosophical Foundations for Health Care Research *(II, 3)* Presentation of the historical and philosophical basis of contemporary health care research. *(Lec. 3) Pre: doctoral standing in nursing or permission of instructor.* Hardy

671 Role Development in Nursing Research *(II, 3)* In-depth examination of the role of the nurse researcher as a member of a multidisciplinary team and in academia. Emphasis on theories and issues related to researcher role development. *(Lec. 2, Lab. 2) Pre: doctoral standing in nursing, 601, 602 or 603, and 660.* Schwartz-Barcott

699 Doctoral Dissertation Research *(I or II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

995 Reading and Research in Nursing *(I or II, 1–6)* Advanced work by individual student on a selected issue in nursing under the direction of a faculty member. *(Lec. 1–6) Pre: graduate standing. S/U credit.* Staff

Ocean Engineering

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Armand J. Silva, Ph.D., 1965, University of Connecticut
Professor Tadeusz Kowalski, Ph.D., 1969, University of Waterloo
Professor Lester R. LeBlanc, Ph.D., 1966, The University of Rhode Island
Professor Vincent C. Rose, Ph.D., 1964, University of Missouri
Professor Malcolm L. Spaulding, Ph.D., 1972, The University of Rhode Island
Professor Peter R. Stepanishen, Ph.D., 1969, Pennsylvania State University
Professor Frank White, Ph.D., 1959, Georgia Institute of Technology
Associate Professor Richard Brown, Ph.D., 1977, University of Cambridge
Associate Professor Peter C. Cornillon, Ph.D., 1973, Cornell University
Associate Professor Robert C. Tyce, Ph.D., 1976, University of California, Scripps Institution of Oceanography
Assistant Professor Sau-Lon James Hu, Ph.D., 1984, Rice University
Adjunct Professor David H. Shonting, Ph.D., 1966, Massachusetts Institute of Technology
Professor Emeritus Foster H. Middleton, Dr. Eng., 1959, The Johns Hopkins University
Professor Emeritus H.E. Sheets, D.Sc., 1936, Technical University, Prague

Specializations

Ocean instrumentation and data analysis, marine hydrodynamics, marine geomechanics, coastal and nearshore processes, coastal and offshore structures, ocean energy systems, remote sensing, materials and corrosion, and underwater acoustics.

Master of Science

Admission requirements: GRE and B.S. degree in engineering, physics, applied mathematics, or other technical disciplines. Students with a nonengineering background may be required to make up deficiencies by taking undergraduate courses in thermodynamics, fluid flow, strength of materials, electrical engineering, or applied mathematics. Applications should be submitted as early in the senior year as possible.

Program requirements: Core requirements of four courses selected from OCE 510, 512, 521, 522, 534, 560, 561, 565, 571, 587, one course selected from OCG 501, 521, or 540, or an advanced-level oceanography course. Thesis option—core requirement plus thesis and at least 12 credits of electives exclusive of OCE 605, 606. Nonthesis option for part-time students—permission of chairperson, core requirements plus 21 credits exclusive of OCE 605, 606, but including at least one course requiring a substantial paper involving significant independent study, and a written master's examination.

Doctor of Philosophy

Admission requirements: GRE and M.S. degree in engineering or other technical discipline, or equivalent; ocean engineering and oceanography core courses as in the master's program. Requirements must have been taken previously or will have to be made up for no program credit.

Program requirements: Ph.D. qualifying examination, dissertation, one advanced applied mathematics course, one graduate-level course in another department, one additional oceanography and two additional ocean engineering courses, completion of 30 credits beyond the master's degree.

Special Financial Aid

Graduate and research assistantships are available for highly qualified students. Some industrial and other fellowships are also available.

General Information

Programs of study can be designed for individuals who are employed on a full-time basis.

OCE Courses
Ocean Engineering

401, 402 (or MCE 401, 402) Introduction to Ocean Engineering Systems I, II *(I and II, 3 each)*

403, 404 (or CHE 403, 404) Introduction to Ocean Engineering Processes I, II *(I and II, 3 each)*

406 (or CVE 406) Introduction to Coastal and Ocean Engineering *(II, 3)*
407 (or CVE 407) Project in Ocean Engineering *(II, 3)*
410 (or MCE 410) Basic Ocean Measurements *(I and II, 3)*
411 (or CVE 411) Basic Coastal Measurements *(I, 3)*

510 Engineering Ocean Mechanics *(II, 3)* Fundamental equations of ocean hydrodynamics. Applications to wave motion and generation, wave spectra, storms, tide, and sediment transport. Hydrodynamic forces and moments. Analysis and numerical modeling of estuarine flows. *(Lec. 3) Pre: MCE 354 or equivalent.* Spaulding or White

512 Hydrodynamics of Floating and Submerged Bodies I *(I, 3)* Hydrodynamic principles associated with floating and submerged bodies: resistance, propulsion, static and dynamic stability. *(Lec. 3) Pre: MCE 455 or equivalent.* Kowalski

513 Hydrodynamics of Floating and Submerged Bodies II *(II, 3)* Continuation of 512. Problems of maneuvering, control, and motions in waves. *(Lec. 3) Pre: MCE 455 or equivalent.* Kowalski

522 Dynamics of Waves and Structures *(I, 3)* Introduction to offshore structures; physical modeling, wave-force models, Morison and diffraction regimes; time and frequency domain techniques for simple oscillators; environmental loadings; random vibration; spectral models; case studies. *(Lec. 3) Pre: MCE 464 or equivalent.* Hu

523 (or CVE 523) Coastal Structures *(II, 3)* Introduction to coastal engineering; review of wave theories for coastal applications; wave forces on coastal structures; seawall, groins, jetties, and breakwaters; construction materials; ports and harbors; ice loading; case studies. *(Lec. 3) Pre: credit or concurrent enrollment in 510 or permission of instructor.* McEwen and Hu

534 (or CHE 534) Corrosion and Corrosion Control *(II, 3)* Chemical nature of metals, electrochemical nature of corrosion. Types of corrosion, influence of environment, methods of corrosion control. Behavior of engineering materials in corrosion with emphasis on industrial and ocean environments. *(Lec. 3) Pre: permission of instructor.* Brown

535 (or CHE 535) Advanced Course in Corrosion *(I, 3)* High-temperature corrosion, oxidation by gaseous environments, industrial problems with high-temperature corrosion. Materials selection and techniques to combat high-temperatures corrosion. *(Lec. 3) Pre: 534 (or CHM 534) or permission of instructor.* Brown and Gregory

537 Advanced Materials Engineering See Chemical Engineering 537.

540 (or MCE 540) Underwater Life Support *(II, 3)* Application of the principles of thermodynamics, heat transfer, and fluid dynamics to the requirements of human survival and engineering operations in deep and shallow water. *(Lec. 3) Pre: permission of instructor.* Tucker

555, 556 Ocean Energy Systems I, II *(I and II, 3 each)* Theory and design of energy extraction from the oceans. Types of ocean power available; principles and systems of energy extraction; design and construction principles. Design project of a power device will be carried out in the second semester. *(Lec. 3) Pre: MCE 345 and 354 or equivalent.* Kowalski

560 Introduction to Data Collection Systems *(II, 3)* Practical problems of data collection. Probes and sensors, interfaces, signal conditioning, and storage. Examples found among the current research areas within ocean engineering will be emphasized. *(Lec. 3) Pre: graduate standing in engineering or permission of instructor.* LeBlanc

561 Introduction to the Analysis of Oceanographic Data *(I, 3)* Design of oceanic experiments to determine spatial and temporal sampling rate, precision, accuracy, signal-to-noise ratio, etc. Description of typical ocean data collection and analysis systems. Development of relevant techniques. *(Lec. 3) Pre: IDE 411, MTH 451, or equivalent.* LeBlanc

565 Ocean Laboratory I *(I or II, 3)* Measurements, experiments, operation of apparatus in the ocean and in the laboratory. Statistical theory, planning multivariable experiments, checking of data, etc. *(Lec. 1, Lab. 6) Pre: graduate standing in engineering or oceanography, or permission of instructor.* Tyce

566 Ocean Laboratory II *(I or II, 3)* Planning long-term experiments in the ocean. Carrying out a synoptic ocean program using vessels, buoys, underwater sensors, and locations of opportunity. Student manages experiment and writes technical report. *(Lab. 6–8) Pre: 565.* Tyce

571 (or ELE 571) Underwater Acoustics I *(I, 3)* Wave equation, energy, pressure and particle velocity. Acoustic properties of the sea. Elementary sources, refraction, reflection, ray theory, normal modes, and scattering, with emphasis on sound propagation in the ocean. *(Lec. 3)* Stepanishen

581 Experimental Geomechanics See Civil and Environmental Engineering 581.

582 (or CVE 582) Seabed Geotechnics *(I or II, 3)* Geotechnical engineering principles as applied to submarine slope stability, bearing capacity, anchoring; emphasis on effective stress principle, compressibility, and shear strength of marine sediments. *(Lec. 3) Pre: CVE 381 or equivalent.* Silva

583 Advanced Foundation Engineering See Civil and Environmental Engineering 583.

591, 592 Special Problems *(I and II, 1–6 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem) Pre: permission of chairperson.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

605, 606 Ocean Engineering Seminar *(I and II, 1 each)* Seminar discussions including presentation of papers based on research or literature survey. *(Lec. 1) Required of all resident graduate students. May be repeated for a maximum of 2 nonprogram credits. S/U credit.* Staff

625 Advanced Marine Structures *(II, 3)* Advanced oscillator models of offshore platforms and equipment; estimates of extreme responses; radiation and scattering of waves by offshore structures; study of fixed, submerged, and compliant offshore structures. *(Lec. 3) Pre: 510, 522, CVE 551 or equivalent.* Hu

626 (or CVE 626) Marine Structural Design *(II, 3)* Introduction to offshore structural design problems; design and simulation of fixed offshore structure, a gravity offshore platform or a coastal structure; design codes and regulations. *(Lec. 3) Pre: CVE 353 and permission of instructor.* McEwen and Hu

661 Analysis of Oceanographic Data Systems *(I, 3)* Design of systems for deep-ocean and estuarine data collection and processing. Space-time sampling, multivariate analysis, and convergence of moments as applied to ocean data estimation and system design. Current topics in ocean data systems. *(Lec. 3) Pre: ELE 506 or equivalent.* LeBlanc

672 (or ELE 672) Underwater Acoustics II *(II, 3)* Transducers, radiators, and receivers, directivity (array structures), equivalent circuits, efficiency; piezoelectricity, magnetostriction, sonar principles, measurements, and calibration. *(Lec. 3)* Stepanishen

673 Advanced Course in Underwater Acoustic Propagation *(I, 3)* Analysis of propagation from a concentrated acoustic source in the ocean by methods such as advanced normal mode theory, numerical integration, and Fast Fourier Transforms. Applications to ocean features such as surface ducts, shadow zones, deep-sound channel, etc. *(Lec. 3) Pre: 571 or equivalent.* Stepanishen

674 Nonlinear Acoustics *(I or II, 3)* Topics in the nonlinear acoustics of fluids, propagation and interactions of finite-amplitude sound waves, parametric sonar, sound generation by turbulence, cavitation noise, shock waves, underwater explosions, radiation pressure and acoustic streaming. *(Lec. 3) Pre: 571 or permission of instructor.* Stepanishen

675 Processing of Underwater Acoustic Data *(II, 3)* Description of the underwater acoustic environment. Methods of measuring underwater acoustic signals. Data analysis of passive and active signals. Applications of underwater acoustics to oceanographic survey. *(Lec. 3) Pre: ELE 506 or equivalent.* LeBlanc

676 Acoustic Radiation from Underwater Vibrators *(I or II, 3)* Fundamentals of acoustic radiation from submerged structures. Radiation from planar, cylindrical, and spherical surfaces. In-vacuo and in-fluid vibration of elastic bodies. Acoustic coincidence and fluid-loading effects on radiation from elastic bodies. *Pre: 571 or permission of instructor.* Stepanishen

688 (or CVE 688) Marine Geomechanics *(I or II, 3)* Integrated study of marine geotechnics and marine geology. Topics include sedimentary processes, acoustic characteristics, slope stability, consolidation and stress history, engineering properties and other subjects related to seabed utilization. *(Lec. 3) Pre: CVE 381 or permission of instructor.* Silva

689 (or CVE 689) Selected Topics in Geomechanics *(I or II, 3)* Advanced topics in geotechnical engineering, including state-of-the-art techniques, methods of analysis and design with applications to professional practice. Specific topic(s) will be selected based on student interest. *(Lec. 3) Pre: CVE 381 or equivalent.* Kovacs, Silva, and Veyera

691, 692 Special Problems *(I and II, 1–6 each)* Advanced work under supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem) Pre: permission of chairperson.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Oceanography

M.S., Ph.D.

Graduate Faculty

Dean: Professor Robert A. Duce, Ph.D., 1964, Massachusetts Institute of Technology
Associate Dean: Professor Margaret Leinen, Ph.D., 1979, The University of Rhode Island
Professor Michael Arthur, Ph.D., 1979, Princeton University
Professor Michael L. Bender, Ph.D., 1970, Columbia University
Professor Robert S. Detrick, Jr., Ph.D., 1978, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution
Research Professor Paul J. Fox, Ph.D., 1972, Columbia University
Professor Paul E. Hargraves, Ph.D., 1968, College of William and Mary
Professor Barry J. Huebert, Ph.D., 1970, Northwestern University
Professor H. Perry Jeffries, Ph.D., 1959, Rutgers—The State University
Professor Dana R. Kester, Ph.D., 1969, Oregon State University
Professor John A. Knauss, Ph.D., 1959, University of California
Professor Roger L. Larson, Ph.D., 1970, University of California, San Diego
Professor Robert L. McMaster, Ph.D., 1953, Rutgers—The State University
Professor Scott W. Nixon, Ph.D., 1969, University of North Carolina
Research Professor Candace A. Oviatt, Ph.D., 1967, The University of Rhode Island
Professor Michael E.Q. Pilson, Ph.D., 1964, University of California, San Diego
Professor James G. Quinn, Ph.D., 1967, University of Connecticut
Research Professor Kenneth A. Rahn, Ph.D., 1971, University of Michigan
Professor Hans T. Rossby, Ph.D., 1966, Massachusetts Institute of Technology
Professor Jean-Guy Schilling, Ph.D., 1966, Massachusetts Institute of Technology
Professor John McN. Sieburth, Ph.D., 1954, University of Minnesota
Professor Haraldur Sigurdsson, Ph.D., 1970, Durham University
Professor Theodore J. Smayda, Dr.Philos., 1967, University of Oslo
Professor Elijah Swift V, Ph.D., 1967, The Johns Hopkins University
Professor D. Randolph Watts, Ph.D., 1973, Cornell University
Professor Howard E. Winn, Ph.D., 1955, University of Michigan
Associate Research Professor Peter Cornillon, Ph.D., 1973, Cornell University
Associate Research Professor Ann G. Durbin, Ph.D., 1976, The University of Rhode Island
Associate Research Professor Edward G. Durbin, Ph.D., 1976, The University of Rhode Island
Associate Research Professor John T. Merrill, Ph.D., 1976, University of Colorado
Associate Professor Theodore A. Napora, Ph.D., 1964, Yale University
Associate Professor Lewis Rothstein, Ph.D., 1983, University of Hawaii
Associate Professor Robert C. Tyce, Ph.D., 1976, University of California, Scripps Institution of Oceanography
Associate Professor Mark Wimbush, Ph.D., 1969, Scripps Institution of Oceanography
Associate Professor Karen Wishner, Ph.D., 1979, Scripps Institution of Oceanography
Associate Professor James A. Yoder, Ph.D., 1978, The University of Rhode Island
Assistant Research Professor Steven N. Carey, Ph.D., 1983, The University of Rhode Island
Assistant Professor Brian G. Heikes, Ph.D., 1984, The University of Michigan
Assistant Research Professor John King, Ph.D., 1983, University of Minnesota
Professor Emeritus Nelson Marshall, Ph.D., 1941, University of Florida
Professor Emeritus Saul B. Saila, Ph.D., 1952, Cornell University

Specializations

Biological, chemical, geological, and physical oceanography.

Master of Science

Admission requirements: GRE (verbal, quantitative, and advanced in the applicant's undergraduate major) and bachelor's degree (B average) in natural sciences or engineering. Most applicants are admitted for September, but admission for the start of the second semester is possible. Due to the limited number of students that can be accepted as degree candidates, no application will be considered showing an undergraduate average of less than B unless there is postbaccalaureate work indicating outstanding ability. Applications should be completed by April 15.

Program requirements: thesis, OCG 695, a minimum of 6 credits of 500- or 600-level oceanography courses outside the student's specialization; participation in a regular ocean research cruise.

Doctor of Philosophy

Admission requirements: GRE (verbal, quantitative, and advanced in the applicant's undergraduate major); master's degree is not required, but bachelor's degree is (B average), in natural sciences or engineering. Most applicants are admitted for September, but admission for the start of the second semester is possible. Due to the limited number of students that can be accepted as degree candidates, no application will be considered showing an undergraduate average of less than B unless there is postbaccalaureate work indicating outstanding ability. Applications should be completed by April 15.

Program requirements: dissertation; for specializations in biological and chemical oceanography—OCG 501, 521, 540, 561; for a specialization in physical oceanography—OCG 501, 510, 613, MCE 551; for a specialization in geological oceanography—OCG 541, 542, and in any two of the following, OCG 501, 521, 561; a minimum of 6 credits of 500- or 600-level oceanography courses outside the specialization; 6 additional credits in oceanography at the 600 level (excluding problems and research courses and OCG 695); participation in regular ocean research cruise. A Ph.D. qualifying examination is required of all doctoral students. This requirement is satisfied by completing, with a grade of B or better, the four core courses specified for the appropri-

ate discipline. Although there is no general language requirement, the student's major professor may require the demonstration of ability in one or more foreign languages.

Special Financial Aid

There is a limited number of assistantships for master's and doctoral candidates.

General Information

It is anticipated that approximately 25 students will be admitted to the program for the 1990–91 academic year.

OCG Courses
Oceanography

401 General Oceanography *(I and II, 3 each)*
491 Ocean Studies *(I and II, 15 each)*
493, 494 Special Problems and Independent Study in Oceanography *(I and II, 1–6 each)*

501 Physical Oceanography *(I, 3)* Basic course covering physical properties of seawater, heat budget, distribution of variables, dynamics, water masses and general circulation, waves and tides. *(Lec. 3) Pre: PHY 213 and MTH 141.* Staff

510 Descriptive Physical Oceanography *(II, 3)* Observed distributions of temperature, salinity, currents; methods of deducing deep flow; physical properties of seawater; flow in estuaries; practical work in the analysis of oceanographic data; study of recent literature. *(Lec. 3) Pre: 501.* Watts

521 Chemical Oceanography *(II, 3)* Processes regulating the composition of seawater and the distribution of chemical species. The interaction of marine chemistry with the ocean floor, atmosphere, and marine organisms. *(Lec. 2, Lab. 2) Pre: CHM 101 and 112 and PHY 213.* Pilson

524 Chemistry of the Marine Atmosphere *(II, 3)* Chemistry and physics of marine aerosols, trace gases, and precipitation; cycles and budgets of atmospheric nitrogen, sulfur, halogen, and carbon compounds; effects of man on the marine atmosphere. *(Lec. 3) Pre: 521 and CHM 432 or permission of instructor. In alternate years. Next offered 1991.* Duce

540 Geological Oceanography *(II, 3)* Origin and evolution of the ocean basin and its margin: morphology, structure, plate tectonics, volcanism, geochemistry, stratigraphy, sedimentation, and paleoceanography. *(Lec. 2, Lab. 2) Pre: GEL 103 or 105 or permission of instructor.* McMaster and Staff

541 Principles of Marine Geology and Geophysics *(I, 4)* Origin, structure, and evolution of ocean basins including plate kinematics, lithospheric origin and dynamics, volcanism, and geochemistry. *(Lec. 3, Lab. 1) Pre: GEL 103 or 102 and 106.* Larson and Staff

542 Principles of Marine Geology and Geophysics *(II, 4)* Marine sedimentary processes, paleo-oceanography, and paleoclimatology and evolution of the Mesozoic-Cenozoic global ocean. *(Lec. 3, Lab. 1) Pre: GEL 103 or 102 and 106.* Arthur and Staff

561 Biological Oceanography *(I, 3)* Nature of life in the sea; adaptations, patterns of distribution and production of plankton, nekton, and benthos, their interrelationships and interaction with the environment. *(Lec. 2, Lab. 2) Pre: ZOO 111.* Winn and Staff

565 The Science of Narragansett Bay *(I, 2)* Group discussion of published literature on Narragansett Bay: analysis and critique. The interrelation of oceanographic disciplines as a basis for planning; guest lectures in related areas. *Pre: major concentration in a scientific discipline and permission of instructor.* Jeffries

574 Biology of Marine Mammals *(II, 3)* Migration, reproduction, social organization, classification, anatomy, populations, physiology, and communications of cetaceans and pinnipeds. *(Lec. 2, Lab. 2) Pre: permission of instructor. In alternate years. Next offered 1990.* Winn

576 (or MIC 576) Marine Microbiology *(I, 4)* The role of bacteria, fungi, apochlorotic algae, flagellates, sarcodines, and ciliates in the cycling of organic matter is discussed in the context of their structure, habitats, trophic modes, ecology, processes, and taxonomy. *(Lec. 3, Lab. 3) Pre: CHM 112 and MIC 201 or 211 or permission of instructor. Offered in odd calendar years.* Sieburth

581 Topics in Tectonic Geology
See Geology 581.

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.* Staff

605 Dynamical Oceanography *(I, 3)* Simple steady-state theories applied to ocean motion. Review of well-known force balances in oceanography, wind-driven circulation, thermohaline circulation, the thermocline, oceanic boundary layers, near-shore circulation, diffusion. *(Lec. 3) Pre: 501.* Rossby

607 Geophysical Models *(I, 1–4)* Selected laboratory experiments modeling the motions of oceans and atmospheres. Comparison of effects of rotation and stratification. Thermal and thermohaline convection, inertial waves and boundary layer phenomena. Emphasis on experimental research techniques and preparation of technical reports. *(Lab. 2–8) Pre: 610 or permission of instructor. May be repeated for a maximum of 4 credits.* Staff

610, 611 Geophysical Fluid Dynamics *(I and II, 3 each)* Physics of ocean circulation; surface wave generation, rotating fluids, density currents, quasigeostrophic motion, laminar viscous flow, turbulence, wind-driven ocean circulation, stratification, convection, thermohaline convection, horizontal convection, and thermoclines. *(Lec. 3) Pre: one course in fluid dynamics and permission of instructor.* Rothstein

613 Waves *(II, 3)* Generation, propagation, and decay of surface waves, internal waves, and Rossby waves in the ocean. *(Lec. 3) Pre: MCE 550 or permission of instructor.* Wimbush

614 Tides *(I, 2)* Generation, propagation, and dissipation of ocean tides. Earth tides. Relation between theory and observation. Tidal analysis. *(Lec. 2) Pre: 501.* Wimbush

620 Chemical Distributions *(II, 3)* Interdisciplinary study of the processes responsible for oceanic chemical distributions with emphasis on conservative properties, biologically active constituents, and radionuclides. Includes projects involving data processing analysis. *(Lec. 3) Pre: 501, 521, 540, and 561 or permission of instructor.* Kester

623 Physical Chemistry of Seawater *(I, 3)* Characterization of dissociation, solubility, and redox equilibria in seawater. Partial molar volumes, conductivity, and diffusion of ions in seawater. Kinetic studies in seawater; effect of temperature, salinity, and pressure on physiochemical properties in seawater. *(Lec. 3) Pre: 521 and CHM 432 or permission of instructor. Offered in odd calendar years. Next offered fall 1989.* Kester

625 Organic Geochemistry *(I, 3)* Chemistry of organic matter in seawater and recent marine sediments. Topics include source, characterization, significance, and fate of dissolved, particulate, and sedimentary organic compounds. *(Lec. 3) Pre: CHM 228 or permission of instructor.* Quinn

628 High-Temperature Geochemistry *(I, 3)* Principles and factors governing the distribution of trace elements in volcanic processes. Applications to the study of rock genesis, mantle dynamics, oceanic crust formation, and hotspots. *(Lec. 3) Pre: CHM 431 or equivalent or permission of instructor. Offered in even calendar years. Next offered fall 1990.* Schilling

629 Isotope Geology *(I, 3)* Principles of natural radioactive growth and decay in closed and open systems. Applications of radiogenic isotopes to the study of the geochemical evolution of the earth's mantle, crust, ocean, and atmosphere. Rock dating. *(Lec. 3) Pre: 628 or permission of instructor. Offered in odd calendar years. Next offered fall 1991.* Schilling

631 Seminar in Marine Chemistry *(I and II, 1)* Discussion of problems of current interest in marine chemistry. *(Lec. 1) Pre: 521 or permission of instructor. S/U credit.* Staff

641 Geology of Continental Margins *(I, 3)* Continental margin formation and evolution within lithospheric plates and at plate boundaries with emphasis on structural patterns, stratigraphic relationships, depositional sequences, and tectonics. *(Lec. 3) Pre: 540, GEL 370 and 550. In alternate years. Next offered fall 1989.* McMaster

643 Subduction Zones *(II, 3)* Structure, petrology, and geochemistry of subduction zones, island arcs, and other magmatic arcs at convergent plate margins. Petrogenesis of andesites and related magmas. *(Lec. 3) Pre: 540 or permission of instructor.* Sigurdsson

644 Global Paleoclimatology *(I, 3)* Principles of modern climatology, climate dynamics, modelling, and climate indicators with application to the geologic record; Phanerozoic climates and relationships to tectonics, paleogeography, and ocean-atmosphere composition. *(Lec. 2, Sem. 1) Pre: 510 and 540. In alternate years. Next offered fall 1989.* Arthur and Leinen

645 Petrology of the Oceanic Crust *(I, 3)* Nature and origin of igneous and metamorphic rocks of the oceanic crust of the earth; mineralogy, petrology, and petrogenesis of sea-floor rocks; metamorphism of the ocean crust. *(Lec. 3) Pre: permission of instructor. In alternate years. Next offered fall 1990.* Sigurdsson

646 Deep-Sea Sediments and Processes *(II, 3)* Deep-sea sediments and their relation to oceanic processes such as solution, productivity, and dilution. Sedimentary distributions in time and space as related to tectonic models. Paleoclimatology, and past water mass distributions and conditions. Term paper. *(Lec. 3) Pre: permission of instructor. In alternate years. Next offered 1991.* Arthur and Leinen

647, 648 Recent Sedimentary Environments *(I and II, 3 each)* A study of sedimentary environments emphasizing the relationships between sediment properties of each environment and its environmental conditions. *647:* beach, estuary, and continental shelf. *648:* continental shelf-break, slope, and rise. *(Lec. 3) Pre: 501, 540, and GEL 550. In alternate years. Next offered 1990–91.* McMaster

649 Paleoceanography and Paleoecology *(I, 3)* Concepts of paleoecology. Review of Pleistocene and Tertiary paleoceanography, paleoclimatology, and paleoecology. Criteria and methods used in marine paleoecology, especially those related to foraminifera radiolaria. Biogeography and paleoecology of Cenozoic planktonic faunas. *(Lec. 2, Lab. 1) In alternate years.* Staff

651 Cenozoic Marine Stratigraphy *(I, 3)* Extensive reading and class discussion of concepts and methods of biostratigraphy, chronostratigraphy, and lithostratigraphy as applied to the Cenozoic. Stratigraphic nomenclature. Problems and advances in correlation and dating of marine sediments from distinct oceanographic regimes including type European sections. *(Lec. 3) In alternate years.* Staff

652 Marine Geophysics *(II, 3)* Survey of basic subdisciplines of marine geophysics including plate tectonics, gravity, magnetics, heat flow reflection, and refraction seismology. Basic theory and methods of data collection and interpretation emphasized. *(Lec. 3) Pre: 540 or permission of instructor.* Detrick

653 Reflection and Refraction Seismology *(I, 3)* Theory and application of marine single-channel, multichannel, and refraction seismic techniques. Topics include theory of elastic wave propagation, instrumentation, method of data collection, and travel time inversion and interpretation techniques. *(Lec. 3) Pre: 540 and 652 or permission of instructor.* Detrick

654 Seminar in Plate Tectonics *(I, 3)* Extensive reading and seminar discussions of plate kinematics, driving forces, the rheology of the lithosphere, and topics of current research interest. Assumes familiarity with basic concepts of geology, geophysics, and vector analysis. *(Sem. 3) Pre: 540 or permission of instructor. Offered in odd calendar years.* Larson

661 (or BOT 661) Phytoplankton Taxonomy *(I, 3)* Classical and modern systems and techniques for the identification, nomenclature, and classification of planktonic algae, with emphasis on marine forms. Phylogeny will be briefly considered. *(Lec. 1, Lab. 4) Pre: permission of instructor. In alternate years. Next offered fall 1990.* Hargraves

663 (or BOT 663) Phytoplankton Physiology *(I, 3)* Metabolic processes and methods of their investigation in phytoplankton with primary emphasis on functions pertinent to their ecology. Includes adaptation, uptake of nutrients, excretion, rhythms, pigments, and photosynthesis. *(Lec. 3) Pre: permission of instructor.* Swift

664 (or BOT 664) Phytoplankton Ecology *(II, 3)* Biology and ecology of the pelagic marine microscopic algae with emphasis on their adaptations, physiological ecology, distribution, succession, production, and regional and seasonal dynamics. *(Lec. 3) Pre: permission of instructor.* Smayda

666 Zooplankton *(II, 3)* Biology of marine zooplankton, dealing with morphology, adaptation, distribution, physiology, production, and interrelationships with other members of the marine biota. *(Lec. 1, Lab. 4) Pre: permission of instructor.* Napora

667 (or BOT 667) Advanced Phytoplankton Seminar *(II, 1)* Specialized and advanced areas of phytoplankton biology and research, including systematics, physiology, and ecology. *(Sem. 2) Pre: permission of instructor. May be repeated. S/U credit.* Hargraves, Smayda, and Swift

670 Fish Population Dynamics *(II, 3)* Methods for estimating vital statistics of fish populations, stock assessment theory and methods, analytical and empirical model development, and fisheries forecasting. *(Lec. 3) Pre: permission of instructor.* Staff

671 Marine Zooplankton Ecology *(II, 3)* Marine zooplankton community structure and function including the relation of spatial and temporal distribution patterns to the oceanic environment, organism interactions, secondary production, feeding, and reproduction. Emphasis on open ocean communities. *(Lec. 3) Pre: 561 or permission of instructor.* Wishner

672 Marine Invertebrates and Environment *(I, 3)* Physiological responses of marine invertebrates to seasonal and geographical changes in the environment. Survival, metabolism, reproduction, and larval development of the populations. Mechanisms in adaptation during stages in life cycle examined in relation to changes of certain environmental factors. Physiological variation of populations related to speciation process. Lectures, reading, and discussion. Research project. *(Lec. 3) Pre: 561 and permission of instructor.* Staff

678 Low-Temperature Geochemistry and Isotope Geology *(II, 3)* A study of processes important in determining the chemical and isotopic mass balance of the oceans and the geochemistry of deep-sea sediments. *(Lec. 3) Pre: 521.* Bender

679 (or ZOO 679) Animal Communication *(II, 2)* Visual, chemical, and auditory communication in animals, including receptor systems, feedback, and redundancy. Functional aspects and organization of communication. Discussion of readings. Research problem can be taken under 691 or ZOO 693. *(Lec. 2) Pre: ZOO 467 or equivalent and permission of instructor. In alternate years. Next offered 1991.* Winn

681 Marine Pollution *(I, 3)* The intricacies of pollution in the marine environment are explored. Following background reviews, representative case studies are presented. *(Lec. 3) Pre: 501, 521, 540, 561, or permission of instructor.* Staff

691, 692 Individual Study *(I and II, 1–6 each)* Individual study of assigned topics or special problems, involving literature search and/or original investigation under one or more members of the staff. *(Lec., Lab. TBA)* Staff

693, 694 Special Studies *(I and II, 1–4 each)* Studies of specialized topics in the marine sciences. *(Lec., Lab. TBA)* Staff

695 Seminar in Oceanography *(I and II, 1 each)* Students to give seminar reports on problems and current research in various areas of oceanography. *(Lec. 1) Attendance and registration are required of all resident graduate students, but no more than 2 credits are allowed for a program of study. S/U credit.* Leinen

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

930 Workshop in Oceanography Topics for Teachers *(I and II, 0–3 each)* Especially designed for teachers of physical sciences. Basic topics in oceanography from an advanced or pedagogical perspective. *(Lec. or Lab.) Pre: teacher certification.* Staff

Note: Graduate students in oceanography choose from supporting courses in other departments.

Pharmaceutics

M.S., Ph.D. (Pharmaceutical Sciences)

Graduate Faculty

Chairperson: Professor Christopher T. Rhodes, Ph.D., 1964, Chelsea College, University of London
Professor Joan M. Lausier, Ph.D., 1971, The University of Rhode Island
Associate Professor Serpil Kislalioglu, Ph.D., 1973, University of London
Assistant Professor Sara Rosenbaum, Ph.D., 1980, University of Liverpool
Assistant Professor David Woodford, Ph.D., 1983, Rutgers—The State University
Adjunct Professor Frederick J. Dechow, Ph.D., 1971, Iowa State University
Adjunct Professor Mahendra G. Dedhiya, Ph.D., 1971, University of Michigan
Adjunct Professor Keith Marshall, Ph.D., 1970, University of Bradford
Adjunct Professor Donald C. Monkhouse, Ph.D., 1970, University of Iowa
Adjunct Professor Ivan G. Otterness, Ph.D., 1968, University of Southern California
Adjunct Professor Greg Stesko, Ph.D., 1978, Purdue University
Adjunct Professor Charles W. Woodruff, Ph.D., 1970, Purdue University
Adjunct Assistant Professor Michele Danish, Pharm.D., 1975, State University of New York at Buffalo
Adjunct Assistant Professor Harald Rettig, Ph.D., 1973, University of Minnesota

Specializations

Pharmaceutics with emphasis on physical pharmacy, biopharmaceutics, pharmacokinetics, formulation and manufacturing pharmacy, and drug standards.

Master of Science

Admission requirements: GRE and bachelor's degree in pharmacy or equivalent, and CSC 201 or equivalent.

Program requirements: thesis; EST 409 or equivalent; BCP 435; PHC 521, 522; 9 credits of 500- or 600-level pharmaceutics courses.

Doctor of Philosophy (Pharmaceutical Sciences)

Admission requirements: same as for master's degree. Qualifying examination is required for all candidates.

Program requirements: M.S. core requirements plus PHC 521, 522, 665, CHE 530, IME 533, 6 credits from CHM 512, MIC 533 and 552, FSN 447, PAD 680, and CHM 511, and 10 additional credits of 500- or 600-level pharmaceutics courses.

PHC Courses Pharmaceutics

425 History of Pharmacy *(II, 3)*
460 (or PHP 460) Nonprescription Drugs and Medical Devices *(I and II, 4)*
497, 498 Special Problems *(I and II, 1–3 each)*

521, 522 Seminar *(I and II, 1 each)* Seminar discussions including presentation of papers on selected topics in pharmacy. *(Lec. 1) Required of all resident graduate students with a maximum of 1 credit allowed per year. May be repeated for a maximum of 2 credits for M.S. candidates. May be repeated for a maximum of 5 credits for Ph.D. candidates.* Staff

535 Pharmacokinetics *(II, 3)* The principles and application of clinical pharmacokinetics for advanced pharmacy students. Developing, modifying, and evaluating dosage regimens. *(Lec. 3)* Rosenbaum and Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

621 Manufacturing Pharmacy *(I or II, 2)* Theory and practice in the manufacture of pharmaceuticals and the principles of operation of the equipment used for their production. *(Lec. 2)* Staff

622 Manufacturing Pharmacy *(I or II, 3)* Theories applied to the manufacture of pharmaceuticals with an emphasis on formulation considerations and principles of operation of equipment used for their production. *(Lec. 3) Pre: 621. In alternate years.* Woodford

623 Manufacturing Pharmacy Laboratory *(I or II, 2)* Practical application of the principles of all aspects of dose-form manufacture, including an emphasis on good manufacturing procedures. *Pre: credit or concurrent enrollment in 622.* Woodford

631 Advanced Physical Pharmacy *(I or II, 4)* Theory and application of physical chemical principles to problems in pharmaceutical research, with emphasis on methods by which properties of new medicinal agents are determined. *(Lec. 4) Pre: permission of instructor.* Kislalioglu

633 Advanced Physical Pharmacy Laboratory *(II, 1)* Laboratory exercises dealing with the physical-chemical principles used in evaluation of pharmaceutical substances. *(Lab. 4) Pre: CHM 435.* Staff

670 Advanced Pharmacokinetics *(I, 1)* Application of classical compartmental and noncompartmental analyses to drug absorption and disposition in linear and nonlinear systems. *(Lec. 1) Pre: 535 or permission of instructor.* Rosenbaum and Staff

680 Industrial Project (Pharmaceutics) *(I, II, or SS, 3)* A research project directed by the major professor on a topic in industrial pharmacy. A report must be submitted to the department faculty. The project will normally be conducted off campus. *Pre: graduate standing in pharmaceutics.* Staff

697, 698 Research in Pharmacy *(I and II, 1–3 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics in pharmacy. *(Lab. TBA)* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Pharmacognosy

M.S., Ph.D. (Pharmaceutical Sciences)

Graduate Faculty

Chairperson: Professor Yuzuru Shimizu, Ph.D., 1963, Hokkaido University
Professor Leonard R. Worthen, Ph.D., 1957, University of Massachusetts
Assistant Professor Ching-Shih Chen, Ph.D., 1985, University of Wisconsin
Assistant Professor Roy K. Okuda, Ph.D., 1983, University of Hawaii
Adjunct Assistant Professor Mostafa M. Omar, Ph.D., 1981, The University of Rhode Island
Professor Emeritus Heber W. Youngken, Jr., Ph.D., 1942, University of Minnesota

Specializations

Biosynthesis of drug plant constituents, natural product chemistry including the isolation and structural elucidation of materials of potential medicinal interest, screening of natural products for physiologically active agents including materials from both land and marine sources.

Master of Science

Admission requirements: GRE and bachelor's degree in pharmacy, chemistry, or biology.

Program requirements: thesis, A.C.S. placement examination (organic) to determine specific program requirement, PCG 445, 446, or equivalent; PCG 548, 551, 552; written master's examination.

Doctor of Philosophy (Pharmaceutical Sciences)

Admission requirements: GRE and master's degree in pharmacy, chemistry, or biology, or bachelor's degree in one of these with evidence of superior ability. Qualifying examination is required for candidates accepted without the master's degree.

Program requirements: PCG 551, 552, 633, 634, CHM 521 or equivalent. A candidate entering the Ph.D. program with a bachelor's degree must also meet the M.S. core course requirements.

PCG Courses
Pharmacognosy

445, 446 General Pharmacognosy *(I and II, 3 each)*

447 General Pharmacognosy Laboratory *(I and II, 1)*

459 Public Health *(I, 3)*

521, 522 Seminar *(I and II, 1 each)* Seminar discussions including presentation of papers on selected topics in pharmacognosy. *(Lec. 1) Required of all resident graduate students with a maximum of 1 credit allowed per year. May be repeated for a maximum of 3 credits.* Staff

533 Medicinal Plants *(I, 2)* Problems in drug plant chemotaxonomy with field work in the drug plant gardens. Emphasis is placed on certain alkaloid, glycoside, and oil-yielding plants. Weedicides and insecticides as related to measures for control. *(Lec. 1, Lab. 3) Pre: 446 or permission of chairperson.* Staff

536 Antibiotics *(II, 3)* Advanced course on concept of antibiosis, biosynthesis pathways of antibiotic production, testing, chemistry, mechanism of action, medicinal and pharmaceutical uses of antibiotics. Phenomena of sensitivity and resistance; emphasis on entities of importance in pharmaceutical research and production. *(Lec. 3) Pre: permission of chairperson. In alternate years.* Worthen

548 Physical Methods of Identification See Medicinal Chemistry 548.

551, 552 Chemistry of Natural Products *(I and II, 3 each)* Introduction to chemistry of certain groups of natural products especially in relation to their chemotaxonomic position in plant classification. Topics limited to secondary metabolites, e.g., terpenoids, phenolic compounds, aromatic compounds, phytosterols, alkaloids. *(Lec. 3) Pre: CHM 228 and 230. In alternate years. Next offered 1989–90.* Shimizu

597, 598 Special Problems *(I and II, 1–3 each)* Special graduate student project assignments in the study of natural drug research under the supervision of faculty. *Pre: graduate standing and permission of chairperson. May be repeated for a maximum of 6 credits.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

633, 634 Biosynthesis *(I and II, 3 each)* Biogenesis of medicinally active principles of biological origin. Emphasis given to organic acids, polysaccharides, glycosides, steroids, and certain nitrogenous compounds. *(Lec. 3) In alternate years. Next offered 1990–91.* Staff

635, 636 Pharmacognosy Techniques *(I and II, 3–4 each)* Physical and chemical factors influencing growth and development of active principles of drug plants. Certain biological analyses of results are performed. *(Lec. 1, Lab. 6–9)* Staff

645 (or PHC 645) Manufacture of Sterile Pharmaceuticals *(II, 3)* Principles of the formulation and production of pharmaceutical sterile products at the industrial level. Selection and evaluation of sterilization techniques. Regulatory aspects of sterile product manufacture. *(Lec. 2, Lab. 3)* - Lausier, Rhodes, and Worthen

697, 698 Research in Pharmacognosy *(I and II, 1–3 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics. *(Lab. TBA)* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Pharmacology and Toxicology

M.S., Ph.D. (Pharmaceutical Sciences)

Graduate Faculty

Chairperson: Professor Zahir A. Shaikh, Ph.D., 1972, Dalhousie University

Professor David R. DeFanti, Ph.D., 1962, The University of Rhode Island

Professor Alvin K. Swonger, Ph.D., 1971, Dartmouth College

Associate Professor Clinton O. Chichester III, Ph.D., 1979, The University of Rhode Island

Associate Professor Robert L. Rodgers, Ph.D. 1977, University of Oklahoma

Assistant Professor John R. Babson, Ph.D., 1980, Oregon State University

Adjunct Professor Alexander R. Malcolm, Jr., Ph.D., 1977, The University of Rhode Island

Adjunct Associate Professor Herbert V. Levinsky, Ph.D., 1969, College of Agriculture, Vienna, Austria

Adjunct Associate Professor Raymond G. Lundgren, Jr., Ph.D., 1963, University of Missouri

Adjunct Associate Research Professor Cecilia T. Giambalvo, Ph.D., 1975, University of Connecticut

Adjunct Assistant Professor Douglas O. Fisher, Ph.D., 1979, The University of Rhode Island

Adjunct Assistant Professor Eugene Jackim, Ph.D., 1965, St. John's University

Professor Emeritus John J. DeFeo, Ph.D., 1954, Purdue University

Specializations

Behavioral, biochemical, and cardiovascular pharmacology; biochemical and forensic toxicology.

Master of Science

Admission requirements: GRE and bachelor's degree in pharmacy, science, or psychology.

Program requirements: thesis; one course in mathematics (141 or equivalent); one course in statistics; PCL 441 and 442; BCP 581 and 582; PCL 521 and 522 and two advanced pharmacology courses.

Doctor of Philosophy (Pharmaceutical Sciences)

Admission requirements: GRE and bachelor's or master's degree in pharmacy or science.

Program requirements: M.S. program requirements with two additional advanced pharmacology courses. In addition, a Ph.D. qualifying examination is required of all students admitted without a master's degree.

PCL Courses
Pharmacology and Toxicology

436 (or PSY 436) Psychotropic Drugs and Therapy *(I and II, 3)*

441, 442 General and Clinical Pharmacology *(I and II, 4 each)*

443 General Pharmacology Laboratory *(I and II, 1)*

497, 498 Special Problems *(I and II, 1–3 each)*

521, 522 Seminar *(I and II, 1 each)* Seminar discussions and presentation of papers on selected topics in pharmacology. *(Lec. 1) Required of all resident graduate students with a maximum of 1 credit allowed per year. May be repeated for a maximum of 3 credits.* Staff

544 Forensic Toxicology *(I, 3)* Theoretical and practical aspects of poisoning including the isolation and identification of toxic materials from pharmaceuticals, body fluids, and tissues. Isolation and identification of physiological fluids from stains, hairs, and

tissue with application to forensic medicine. *(Lec. 2, Lab. 3) Pre: 441, 442, and permission of chairperson. In alternate years. Next offered spring 1990.* DeFanti

546 Advanced Toxicology *(II, 3)* Toxic effects of selected drugs and other xenobiotics on physiological and biochemical processes. *(Lec. 3) Pre: 441 and 442 and permission of chairperson. In alternate years. Next offered fall 1990.* Shaikh

572 Neural Bases of Drug Action *(I, 3)* Review of neuroanatomy, neurochemistry, and neurophysiology as they relate to drug action. *(Lec. 3) Pre: 441 or equivalent and/or permission of chairperson. In alternate years. Next offered fall 1989.* Swonger

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

641 Biochemical Pharmacology *(II, 3)* Theory and application of pharmacological studies at the cellular and subcellular levels and their significance to drug action in the intact organism. *(Lec. 3) Pre: 441 and 442 and permission of chairperson. In alternate years. Next offered spring 1991.* Chichester

642 Biochemical Toxicology *(II, 3)* Biochemical and molecular aspects of chemically induced cell injury and chemical carcinogenesis. *(Lec. 3) Pre: BCP 581, 582 and 441, 442, or permission of chairperson. In alternate years. Next offered spring 1991.* Babson

643 Advanced Pharmacology and Techniques *(I, 4)* Mechanism of action of drugs on living tissues, organs, and organisms, with particular emphasis on cellular physiology as a basis of explanation of tissue response. Advanced laboratory techniques as employed for pharmacological testing. *(Lec. 2, Lab. TBA) Pre: 442 and permission of chairperson. In alternate years.* Staff

644 Cardiovascular Pharmacology *(II, 3)* Cellular mechanisms of drug action as a basis for understanding therapeutic effects. Emphasis on current developments in antihypertensive, antiarrhythmic, antianginal, and cardiotonic drug research. *(Lec. 3) Pre: 441 and 442 or equivalent. Next offered fall 1991.* Rodgers

697, 698 Research in Pharmacology *(I and II, 1–5 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics. *(Lab. TBA)* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Pharmacy Administration
M.S.

Graduate Faculty

Chairperson: Professor Albert H. Taubman, Ph.D., 1971, University of Pittsburgh
Professor Norman A. Campbell, Ph.D., 1972, University of Wisconsin
Assistant Professor Cynthia Willey, Ph.D., 1985, University of North Carolina, Chapel Hill
Adjunct Professor Armand P. Leco, B.S., 1947, Providence College
Adjunct Assistant Professor Charles Hachadorian, Jr., M.P.A., 1969, The University of Rhode Island
Adjunct Instructor John H. Grant, M.B.A., 1976, Bryant College
Adjunct Instructor Robert F. Menard, B.S., B.A., 1964, Boston College

Specializations

Development and utilization of pharmacy resources in health care systems involving the organization, financing, and delivery of health care services and materials and the legal and socioeconomic constraints.

Master of Science

Admission requirements: GRE or MAT and first professional degree in pharmacy.
Program requirements: thesis; PHP 599, 621, 622, 651, 652, EST 409, or equivalents.

Special Financial Aid

Fellowships from the American Foundation for Pharmaceutical Education.

PHP Courses
Pharmacy Practice

405 Personnel Administration *(I, 3)*
406 Pharmacy Retailing *(II, 3)*
451, 452 Pharmacotherapeutics I, II *(I and II, 3 each)*
453 Drug Marketing Principles *(II, 2)*
460 (or PHC 460) Nonprescription Drugs and Medical Devices *(I and II, 4)*
480 Prepaid Drug Plans *(I, 3)*
497, 498 Special Problems *(I and II, 1–3 each)*

501 Drug Information Pertaining to Institutional Pharmacy Practice *(I, 3)* Discussion and evaluation of drug information sources and how to use these sources. Includes the methodology of establishing and maintaining drug information services. *(Lec. 2, Pract. 3)* Generali

530 Behavioral Skills in Clinical Pharmacy *(SS, 3)* Communication skills, behavioral aspects of illness, and the social and ethical considerations of clinical pharmacy. *(Lec. 3) Pre: enrollment in Doctor of Pharmacy program or permission of chairperson.* Staff

540 Principles, Methods, and Applications of Epidemiology *(I, 3)* An introduction to epidemiology, the study of health and disease in populations. Epidemiologic methods and research design for conducting and interpreting health research. *(Lec. 3) Pre: EST 407 or permission of instructor.* Willey

570 Case Studies in Pharmacy Law *(II, 3)* Case studies and a detailed analysis of the FDC, Controlled Substances Act, and health insurance laws. *(Lec. 3) Pre: 351. In alternate years.* Campbell

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

621, 622 Seminar *(I and II, 1 each)* Seminar discussions and presentation of papers on selected topics in pharmacy administration. *(Lec. 1) Required of all resident graduate students with a maximum of 1 credit allowed per year. May be repeated for a maximum of 3 credits.* Staff

651, 652 Health Care Systems I, II *(I and II, 3 each)* Arrangements for utilizing pharmaceutical resources in public and private systems of health care in the United States and other countries. Variations in quality and distribution of care among socioeconomic groups. *(Lec. 3) Pre: 480 and EST 308 or 409, or equivalent.* Taubman and Campbell

680 Legal Environment in Health Administration *(I, 3)* Application of specialized statutory and regulatory provisions in federal and state law to the delivery of health care. *(Lec. 3) Pre: graduate standing.* Campbell

697, 698 Research in Pharmacy Administration *(I and II, 1–3 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics in pharmacy administration. *(Lab. TBA)* Staff

Doctor of Pharmacy
Pharm.D.

Graduate Faculty

Director of Clinical Pharmacy Programs: Associate Professor Edward J. Mattea, Pharm.D., 1974, Philadelphia College of Pharmacy and Science
Associate Professor Michael N. Dudley, Pharm.D., 1980, University of California, San Francisco
Associate Professor Norma J. Owens, Pharm.D., 1979, Philadelphia College of Pharmacy and Science
Associate Professor Stanley S. Weber, Pharm.D., 1975, University of Cincinnati
Assistant Professor Elena Bablenis, Pharm.D., 1986, The University of Rhode Island

Assistant Professor Anne L. Hume, Pharm.D., 1982, Virginia Commonwealth University, MCV Campus
Assistant Professor Marilyn McFarland, Pharm.D., 1982, University of California, San Francisco
Assistant Professor Kimberly Thrasher, Pharm.D., 1986, Medical University of South Carolina
Clinical Assistant Professor Joyce Generali, M.S., 1983, University of Kansas

Specializations

The Doctor of Pharmacy program is designed for students desiring excellence in the field of clinical pharmacy practice. It prepares students for advanced positions in practice, industry, government, clinical research, and academia. The focus of the program is on application of pharmacotherapeutics to individual patients.

Doctor of Pharmacy

Admission requirements: B.S. in pharmacy, GRE, a grade point average of approximately B or above, and three letters of recommendation.

Program requirements: A nonthesis program requiring 61 credits including—PHP 530, 542, 611, 612; PHC 535, and EST 407; 18 credit hours of integrated medical science coursework (PHP 671, 672) offered in conjunction with Brown University Medical School; and 1,800 hours (24 credits) of clinical clerkship and a research project in affiliate hospitals (PHP 690). Candidates lacking acceptable undergraduate courses in pathology, anatomy, human physiology, biochemistry, immunology, and pharmacokinetics will be required to make up deficiencies. Written comprehensive examinations and presentation of the research project are required.

PHP Pharmacy Practice Courses for Doctor of Pharmacy Program

530 Behavioral Skills in Clinical Pharmacy *(SS, 3)* Communication skills, behavioral aspects of illness, and the social and ethical considerations of clinical pharmacy. *(Lec. 3) Pre: enrollment in Doctor of Pharmacy program or permission of chairperson.* Staff

542 Drug-Induced Diseases *(I, 2)* An overview of diseases induced or aggravated by drug therapy. The course is organized using an organ system/disease-state approach. *(Lec. 2) Pre: enrollment in Doctor of Pharmacy program or 451 and 452.* Weber and Staff

544 Physical Assessment *(II, 1)* Organ system approach to components of physical examination and evaluation. Emphasis is placed on understanding those physical signs and symptoms which may be drug induced. Practice skills are introduced. *(Lec. 3) Pre: enrollment in the Doctor of Pharmacy program or permission of instructor.* Thrasher

611, 612 Advanced Pharmacotherapeutics I, II *(I, 3 each)* The clinical use of medication in a disease-oriented approach. Correlated basic concepts of pharmacology, pharmacy, pathophysiology, and biochemistry related to treatment of diseases. *(Lec. 3) Pre: enrollment in the Doctor of Pharmacy program.* Staff

671, 672 Integrated Medical Sciences I, II *(I and II, 6–12 each)* The pathophysiology of the hematologic, gastrointestinal, respiratory, endocrine, renal, reproductive, supporting structure and cardiovascular systems; biomedical topics in nutrition; and the biomedical basis of infectious disease. Offered by the Brown University Program in Medicine as part of the Integrated Medical Science Sequence. *(Lec. 18) Pre: enrollment in Doctor of Pharmacy program. May be repeated for a maximum of 18 credits.* Staff

681, 682 Clinical Pharmacy Seminar I, II *(I, 1 each)* Presentation made by students on appropriate advanced clinical pharmacy topics. *(Sem. 2) Pre: enrollment in the Doctor of Pharmacy program.* Mattea

690 Advanced Clinical Pharmacy Clerkship and Research *(I, II, and SS, 2–9)* Application and development of advanced clinical skills and knowledge, communication techniques, and clinical research. Skills refined by functioning as a clinical pharmacist in a clinical practice site under the supervision of a faculty member. *(Lab. 40) Pre: enrollment in the Doctor of Pharmacy program. Must be repeated for a total of 24 credits.* Staff

Philosophy
M.A.

Graduate Faculty

Chairperson: Professor Fritz Wenisch, Ph.D., 1968, University of Salzburg
Professor John W. Hanke, Ph.D., 1967, Indiana University
Professor Galen A. Johnson, Ph.D., 1977, Boston University
Professor Yong Choon Kim, Ph.D., 1969, Temple University
Professor John F. Peterson, Jr., Ph.D., 1965, Indiana University
Professor Stephen D. Schwarz, Ph.D., 1966, Harvard University
Professor Donald J. Zeyl, Ph.D., 1972, Harvard University
Associate Professor James G. Kowalski, Ph.D., 1975, University of Notre Dame
Assistant Professor Lynn Pasquerella, Ph.D., 1985, Brown University
Assistant Professor Mark Roberts, Ph.D., 1987, University of Dallas
Professor Emeritus William Young, B.Litt., 1958, University of Oxford

Specializations

Programs of study are offered in the following general areas: logic and philosophy of science, axiology, and history of philosophy.

Master of Arts

Admission requirements: GRE, 18 credits in basic philosophy courses (students whose undergraduate preparation did not include at least 18 credits in basic philosophy courses will be required to take these in addition to the graduate program requirements).

Program requirements: thesis option—24 credits in coursework, 6 credits in master's thesis research. Nonthesis option—30 credits in coursework, comprehensive examination. Students in both options will normally include 6 credits in disciplines other than philosophy. Proficiency in a foreign language will be required if the student's program committee considers it essential for the thesis topic or the substantial paper involving significant independent research to be written by students choosing the nonthesis option.

PHL Courses
Philosophy

401, 402 Special Problems *(I and II, 3 each)*
414 Advanced Studies in Ethics *(I or II, 3)*
440 Philosophy of Language *(I or II, 3)*
451 Symbolic Logic *(I or II, 3)*
453 Philosophy of the Social Sciences *(II, 3)*

502, 503 Tutorial in Philosophy *(I and II, 3 each)* Discussion by the staff and advanced students of research problems in philosophy. Presentation and criticism of original papers. *(Lec. 3) Pre: graduate standing or permission of instructor. May be repeated for a maximum of 9 credits.* Staff

513 General Axiology *(I or II, 3)* Intensive historical and systematic study of issues such as the nature and kinds of values, their ontological status, their relation to culture, their relation to emotions, relation of axiology to other disciplines. *(Lec. 3) Pre: graduate standing or permission of instructor.* Wenisch or Staff

530 Philosophy of Plato *(I or II, 3)* Selected dialogues from the later period. Particular attention will be given to the areas of metaphysics, epistemology, cosmology, and ethics. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Zeyl

531 Philosophy of Aristotle *(I or II, 3)* Selected texts with emphasis on the major concepts of Aristotle's metaphysics, theory of knowledge, and ethics. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Zeyl

542 Advanced Studies in Patristic and Scholastic Philosophy *(I or II, 3)* Intensive studies of one or more thinkers belonging

to the patristic or scholastic tradition. The specific subject may change from year to year. *(Lec. 3) Pre: graduate standing or permission of instructor.* Peterson

551 Philosophical Logic *(I or II, 3)* Intensive consideration of such issues as the nature, structure, and function of propositions, predication, analysis of the "is" relation. Relation between proposition and facts. Nature of logic and criterion of the logical, relation of logic to language, psychology, and ontology. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Staff

555 Philosophy of the Arts and of Literature *(I or II, 3)* An intensive study of one or more thinkers concerned with philosophical problems arising from our experience of the arts and of literature. The phenomenological tradition will be stressed. *(Lec. 3) Pre: graduate standing or permission of instructor.* Hanke

570 Philosophy of Immanuel Kant *(I or II, 3)* Intensive analysis of major texts. Special attention will be given to *The Critique of Pure Reason. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Peterson or Staff

580 Nineteenth-Century Philosophy *(I or II, 3)* Intensive analysis of the work of a major philosopher or philosophical movement. Attention will be given to such major figures as Hegel, Kierkegaard, C.S. Peirce, or James. The specific subject changes from year to year. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Staff

582 Advanced Studies in Contemporary Philosophy *(I or II, 3)* Intensive studies of one or more thinkers of philosophical movements of the twentieth century. The specific subject may change from year to year. *(Lec. 3) Pre: graduate standing or permission of instructor.* Young or Staff

599 Master's Thesis Research *(I and II)* Number or credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Physical Education
M.S.

Graduate Faculty

Chairperson: Associate Professor Jeannette E. Crooker, M.S., 1959, The University of Rhode Island
Professor Lorraine C. Bloomquist, Ed.D., 1974, Boston University
Professor Thomas Manfredi, Ph.D., 1976, University of Massachusetts
Professor Raymond A. Nedwidek, Ed.D., 1965, University of Pittsburgh
Professor Robert J. Sonstroem, Ph.D., 1968, University of Minnesota
Associate Professor Greta L. Cohen, Ed.D., 1981, Boston University
Associate Professor Leo E. O'Donnell, Ed.D., 1970, Temple University
Associate Professor John O'Leary, M.S., 1963, Southern Connecticut State College
Associate Professor J. Richard Polidoro, D.P.E., 1969, Springfield College
Associate Professor Mark J. Rowinski, Ph.D., 1976, Medical College of Georgia
Associate Professor Diane Seleen, Ed.D., 1981, Boston University
Assistant Professor Bo Fernhall, Ph.D., 1984, Arizona State University

Specializations

Physical education, administration, exercise science, health education, sport and recreation management, recreation education, adapted physical education, gerontology, psychology of sport, and international sport and physical education.

Master of Science

Admission requirements: MAT or GRE with B.S. degree in physical education, health and physical education, or health education. In exceptional cases, a candidate without a major in physical education or a related area but with a strong emphasis in physical education is accepted.

Program requirements: thesis—30 credits including PED 510, 530, 599, 3 credits from PED 578, 581, or 582, and 3 credits from PED 559, 562, or 585; nonthesis option—33 credits including PED 510, 530, 591, 3 credits from PED 578 or 581, and 3 credits from PED 559, 562, or 585, and a written master's comprehensive examination. In addition to the program requirements, all students choosing the international sport and physical education specialization must select 12 credits from PED 526, PED 592, and REN 595 or PSC 431. Students choosing the nonthesis program in this specialization must select an additional 6 credits from PED 560, RCR 485, and REN 595 or PSC 431.

PED Courses
Physical Education

410 Corrective and Adapted Physical Education *(I and II, 3)*
430 Adapted Aquatics *(I, 3)*
450 Theoretical Aspects of Track and Field Athletics *(II, 3)*
466 Modern Dance Choreography *(I or II, 3)*
475 Women in Sports *(I or II, 3)*
480 Application of Biomechanics to Coaching Athletics *(I or II, 3)*
484 (or HLT 484 or RCR 484) Supervised Field Work *(I and II, 6 or 12)*
486 (or HLT 486 or RCR 486) Field Experience Seminar *(I and II, 3)*

510 Current Issues in Physical Education, Health, and Recreation *(I or II, 3)* Designed to develop student awareness of contemporary situations that are of concern to the above professions. Extensive review of contemporary literature. Critical analysis of selected issues, their components, and effects. *(Lec. 3) Pre: permission of instructor.* Polidoro

520 Curriculum Construction in Physical Education *(I or II, 3)* Analysis of criteria and procedures for curriculum construction in physical education. Standards for the evaluation and revision of elementary and secondary school physical education courses. *(Lec. 3) Pre: permission of instructor.* Crooker

525 Comparative Physical Education and Sport *(I or II, 3)* Examination of the status and practice of sport and physical education in selected countries. Emphasis on comparative analyses in developed and third world countries. *(Lec. 3) Pre: graduate standing or permission of instructor.* Polidoro

526 Sport and International Relations *(I or II, 3)* An examination of the role that sport plays in promoting international relations. Special lectures, readings, library research on topics relating to sport and international relations. *(Lec. 3) Pre: graduate standing or permission of instructor.* Polidoro and Doyle

530 Research Methods and Design in Health and Physical Education *(I or II, 3)* Introduction to methodology in experimental, laboratory, curriculum, action, and historical research. *(Lec. 3) Pre: competence in basic statistics and permission of instructor.* Sonstroem and O'Donnell

531 Advanced Experimental Techniques in Physical Education *(II, 3)* In-depth analysis of research studies in the field. Advanced research technique studied and applied to problems in physical education. *(Lec. 3) Pre: 530 or permission of instructor.* Staff

550 Administration of Physical Education *(I or II, 3)* Problems and procedures for administering a physical education program studied from the viewpoint of the physical education administrator, the school administrator, and the faculty. Emphasis is placed on the study of administrative cases. *(Lec. 3) Pre: 380 or permission of instructor.* Nedwidek, Polidoro, or Crooker

551 Sport and Recreation Operations *(I or II, 3)* Analysis of operational problems and policies associated with interscholastic, intercollegiate, professional, community, and commercial sports enterprises. *(Lec. 3) Pre: 380 or graduate standing.* Nedwidek and Crooker

552 Supervision of Physical Education and Health Instruction *(I or II, 3)* Principles, techniques, and procedures involved in effective supervision of physical education and health instruction, with emphasis on the leadership role of the supervisor in the improvement of instruction. *Pre: graduate standing or permission of instructor. (Lec. 3)* Nedwidek

559 Principles of Exercise Testing and Interpretation *(I or II, 3)* Theory and practical application of exercise testing and interpretation. Includes information on testing of athletes as well as clinical testing and interpretation. *(Lec. 3) Pre: ZOO 343 or permission of instructor.* Fernhall and Manfredi

560 (or HLT 560) Seminar in Health, Physical Education, and Recreation *(I or II, 3)* Selected topics within the three areas, depending on availability of specialized instruction including visiting professorship. *(Lec. 3) Pre: permission of instructor.* Staff

562 Advanced Exercise Physiology *(I or II, 3)* Advanced study of the physiological factors limiting physical performance and work capacity with emphasis on the effects of physical conditioning on health and fitness. *(Lec. 3) Pre: ZOO 343 or permission of instructor.* Manfredi

563 Fitness Programs for the Middle-Aged and Elderly *(I or II, 3)* Provides the professional physical educator with an in-depth knowledge of scientific principles applicable to the administration of adult physical fitness programs. Client characteristics, screening, program supervision, liability, recruitment, and adherence. *(Lec. 3) Pre: graduate standing or permission of instructor.* Fernhall

564 Physiology of Aging *(I or II, 3)* Library searches, reports, and discussion of topics of current research on the physiology of aging. Subject matter adapted to meet interests of staff and students. *(Lec. 3) Pre: ZOO 242 or permission of instructor.* Manfredi

565 Cardiovascular Rehabilitation *(I or II, 3)* Focus on cardiac rehabilitation, underlying pathology and pathophysiology, diagnostic and prognostic testing, and principles of rehabilitation. Special emphasis on exercise intervention and lifestyle change. *(Lec. 3) Pre: ZOO 343 or permission of instructor.* Fernhall and Manfredi

570 (or HLT 570) Major Health Problems and Curriculum Planning in Health Education *(I or II, 3)* Major health problems related to personal and community health with emphasis on health education, curriculum planning, and evaluation. *(Lec. 3) Pre: permission of instructor.* O'Donnell

575 Perceptual-Motor Education *(I or II, 3)* Role of motor activity in enhancing perceptual development. How the physical educator can become involved with other school personnel in the implementation and continuing development of perceptual-motor programs. For teachers in elementary schools and in special education who wish to incorporate motor activities into their programs. *(Lec. 3) Pre: PSY 113, 232, and permission of instructor.* Staff

578 Sport in American Culture *(I or II, 3)* A survey of contemporary themes relating to the study of human behavior in sports contexts in American culture. *(Lec. 3) Pre: graduate standing or permission of instructor.* Cohen

580 Physical Education: Mentally Retarded and Learning Disabled *(I or II, 3)* Contributions of physical education to the growth and development of the mentally retarded and learning disabled. Theoretical and practical aspects of programs to best serve their individual needs. *(Lec. 3) Pre: permission of instructor.* Bloomquist

581 Psychological Aspects of Healthy Lifestyle *(I or II, 3)* Psychosocial variables involved in health maintenance and recovery from disease with emphasis on compliance in exercise. A review of models and research identifies client needs and counseling methods. *(Lec. 3) Pre: graduate standing, PSY 113 and 232, or permission of instructor.* Sonstroem

582 Sport Psychology *(I or II, 3)* Counseling and psychotherapeutic techniques to improve athletic performance. Considers needs of the athlete arising from competitive stress, staleness, failure, team structure, and interactions. *(Lec. 3) Pre: graduate standing, PSY 113 and 232, or permission of instructor.* Sonstroem

585 Adapted Physical Activities for Special Populations *(I, 3)* Characteristics and needs for special populations: retarded, emotionally disturbed, learning disabled, sensory impaired, and obese. Adapted activities based on individual needs. Effects of federal legislation on programs discussed. *(Lec. 3) Pre: permission of instructor.* Bloomquist

591 (or HLT 591) Special Problems *(I or II, 3)* Written paper reporting an in-depth investigation of a pertinent problem in the field, including a review of relevant literature, analysis, and solution of the problem based on scientific methodology, with recommendations for improved practices. *Limited to and required of all graduate students in physical education who elect the nonthesis option.* Staff

592 (or HLT 592 or RCR 592) Internship in Physical Education *(I, II, or SS, 3)* Directed field experience under the supervision of a faculty member and a professional staff member of the cooperating institution. Application of knowledge, synthesis of practical experiences. Paper required. *Pre: a minimum of 12 graduate credits in physical education and permission of major professor and chairperson.* Staff

595 (or HLT 595) Independent Study *(I or II, 3)* Development of an approved project supervised by a member of the graduate faculty. *Pre: permission of chairperson and instructor. May not be substituted for 591 or 599.* Staff

599 (or HLT 599) Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.* Staff

HLT Courses
Health

457 (or CNS 457) Health and Safety Issues of Consumer Products *(I or II, 3)*
459 Birth Defects: Family and Community Health Perspectives *(SS, 3)*
484 (or PED 484) Supervised Field Work *(I and II, 6 or 12)*
486 (or PED 486) Field Experience Seminar *(I and II, 3)*

560 Seminar in Health, Physical Education, and Recreation
See Physical Education 560.

570 Major Health Problems and Curriculum Planning in Health Education
See Physical Education 570.

591 Special Problems
See Physical Education 591.

592 Internship
See Physical Education 592.

595 Independent Study
See Physical Education 595.

599 Master's Thesis Research
See Physical Education 599.

RCR Courses
Recreation

416 Aging and Leisure *(I or II, 3)*
484 (or PED 484) Supervised Field Work *(I and II, 6 or 12)*
485 Planning and Supervision of Recreational and Athletic Facilities *(I, 3)*
486 Field Experience Seminar *(I and II, 3)*

592 Internship
See Physical Education 592.

Physical Therapy
M.S.

Director: Associate Professor Mark J. Rowinski, Ph.D., 1976, Medical College of Georgia
Academic Coordinator of Clinical Education: Robert A. McArdle, M.Ed., 1987, Northeastern University
Assistant Professor Marjorie A. Moore, Ph.D., 1987, University of Iowa

An entry-level Master of Science degree program in physical therapy has been approved by the Board of Governors for Higher Education. The first class of students enrolled in the fall of 1988. Some of the requirements listed below are subject to change. For additional information, contact the program director.

Master of Science

Admission requirements: GRE (Aptitude Test scores at the 50th percentile or above are desired) and a bachelor's degree with 12 credits of biological sciences (including human anatomy and human physiology);

physical sciences (preferably 16 credits, 8 in chemistry and 8 in physics); 6 credits of social sciences including general and developmental psychology; 3 credits in mathematics (preferably precalculus); 3 credits in communications (preferably writing or speech). Courses in abnormal psychology, computer science, exercise physiology, and statistics are strongly recommended but not required.

A clinical experience with a physical therapist is required. The experience should include observing and aiding a physical therapist in treatment or evaluation procedures. The minimum number of hours recommended for the clinical experience is 30–40 hours of voluntary or paid time. The experience may be part of field work study for credit in a health-related discipline. Evidence of such experience should be documented by a letter of recommendation from the physical therapist addressing the nature and duration of the experience. This letter of recommendation should be submitted as part of the application process. Baccalaureate requirements must be completed prior to final acceptance into the master's program. The deadline for applications is February 15, when the available pool of applicants is reviewed for September admission.

Program requirements: A minimum of 83 credits of specified physical therapy coursework, including 15 credits of internship. This program is a three-year plan of required coursework, with the first two semesters at the 400 and 500 level (29 credits) followed by four semesters and a summer session of graduate-level coursework including internships at affiliated institutions. Though essentially a nonthesis program, a substantial paper involving significant independent research is required. A course in statistical methods, EST 407 or its equivalent, is required prior to or concurrent with the first semester of the second year of the program. All coursework involving clinical skill development requires skill competency testing via practical examination. All clinical competencies determined necessary by the faculty of the respective course must be demonstrated as adequately learned by the student in these courses for achievement of an adequate scholastic course grade. (Please see "Scholastic Standing" in the Degree Requirements section of this catalog.)

PHT Courses

410 Human Anatomy, Embryology, and Histology *(I, 5)*

412 Basic Physical Evaluation, Therapeutic Exercise, and Care *(I, 3)*

417 Psychosocial Needs of the Disabled *(I, 2)*

418 Professional and Community Practices in Physical Therapy *(I, 2)*

420 Physiological Basis of Physical Therapy *(I, 3)*

422 Pathophysiology and Medical Management of Movement Disorders *(II, 3)*

430 Human Neurosciences and Neurology *(II, 4)*

510 Biomechanics and Pathokinesiology *(II, 3)* Principles, theories, and recent investigations of the biomechanics of human motion and posture are presented to develop analytical skills for normal and abnormal movement evaluation. *(Lec. 2, Lab. 3) Pre: 410, 412, 420, or permission of instructor.* Staff

515 Research Methods in Physical Therapy *(I, 3)* Research design and methods in current physical therapy theory development and scientific literature. Preparation of a research proposal through review of literature and pilot study of selected research methods are required. *(Lec. 3) Pre: credit or concurrent enrollment in EST 407 or equivalent and second-year standing in physical therapy or permission of instructor.* Staff

518 Ethical, Legal, and Interdisciplinary Issues of Clinical Practice *(I, 2)* Standards, ethical considerations, and legal implications of physical therapy practice. Communication with other health care disciplines and governmental agencies for the provision, progression, and implementation of physical therapy services. *(Lec. 2) Pre: second-year standing in physical therapy or permission of instructor.* Staff

525 Research Projects in Physical Therapy I *(I, 3)* Development of an investigation into some problem of basic or applied physical therapy science. Case studies, preliminary data, or survey instruments are compiled, and a review of related literature is accomplished under guidance of faculty. *Pre: 515, third-year standing in physical therapy, or permission of instructor.* Staff

528 Professional Practice and Administration *(II, 3)* Responsibilities of the physical therapist in supervising personnel and establishing therapeutic practice in hospital, outpatient, and private settings. Department planning, personnel development, cost accounting and billing, standards of practice, and quality assurance are discussed. *(Lec. 3) Pre: second-year standing in physical therapy or permission of instructor.* Staff

532 Physical Agents and Instrumentation in Physical Therapy *(II, 4)* Theory, clinical investigations, and current research regarding the application of physical therapeutic energies and agents. Direct treatment techniques and supervision of support personnel in the administration of mechano-, electro-, thermo-, hydro-, ionto-, and phototherapy. *(Lec. 3, Lab. 3) Pre: 420, second-semester standing in physical therapy or permission of instructor.* Staff

535 Research Project in Physical Therapy II *(II, 3)* Completion of investigation into some problem of basic or applied physical therapy science. Data gathering is completed, results are summarized, and conclusions relating findings to previous studies are formulated. *Pre: 525 or permission of instructor.* Staff

540 Human Motor Development and Learning *(I, 3)* Development and maturation of the human nervous system forms the basis for clinical considerations of developmental disabilities and motor learning. Theories of motor skill acquisition and therapeutic interventions for neuromuscular problems of the infant, child, adolescent, and adult. *(Lec. 2, Lab. 3) Pre: 410, 430, second-year standing in physical therapy, or permission of instructor.* Staff

542 Clinical Diagnosis *(I, 2)* Modern medical and therapeutic diagnostic methods are presented to develop competencies in referral and evaluation of disorders. Medical and pharmacological science topics pertaining to physical therapy diagnoses are presented by invited lecturers. *(Lec. 2) Pre: second year standing in physical therapy or permission of instructor.* Staff

550 Orthopaedic Physical Therapy *(I, 3)* Physical evaluation and treatment techniques of the human muscular, articular, and skeletal systems related to orthopaedic conditions. Rehabilitation of injured, congenitally dysfunctioning, surgically intervened patients, and patients with conditions at risk for dysfunction. *(Lec. 2, Lab. 3) Pre: 410, 412, 420, 510; second-year standing in physical therapy or permission of instructor.* Staff

552 Functional Rehabilitation and Advanced Therapeutic Exercise *(II, 3)* Patient care techniques and programs related to the restoration of functional motor activities are provided through specification of treatment protocols, assistive devices, therapeutic apparatus, and therapeutic exercise programs. Competency is developed by simulating actual clinical conditions. *(Lec. 2, Lab. 3) Pre: second-year standing in physical therapy or permission of instructor.* Staff

560 Neurological Physical Therapy *(II, 3)* Physical therapy for the neurologically disabled patient. Proprioceptive neuromuscular facilitation, neurodevelopmental, sensory–motor integration, other patterned stimulation and evaluation techniques with emphasis on stroke, spinal cord injury, and other disabling conditions of the nervous system. *(Lec. 2, Lab. 3) Pre: 430, ZOO 242, second-year standing in physical therapy, or permission of instructor.* Staff

570 Cardiopulmonary Physical Therapy *(II, 3)* Physiological basis, testing and evaluation, treatment, and administration of programs for cardiac and pulmonary-diseased patients requiring physical therapy. *(Lec. 2, Lab. 3) Pre: 420, 422, second-year standing in physical therapy, or permission of instructor.* Staff

575 Physical Therapy Internship I *(SS, 5)* Assignment to various clinical settings which provide supervised experiences with practicing physical therapists and support personnel. Specific setting and rotational time schedule is determined by the academic clinical coordinator and clinical staff. *Pre: third-year standing in physical therapy or permission of instructor.* Staff

580 Pediatric and Geriatric Physical Therapy *(I, 3)* Specific problems of the maturing and aging patient population in physical therapy practice. Developmental disability programs and treatment programs in nursing facilities, treatment centers, and home programs for the aged patient population. *(Lec. 3) Pre: 430, 540, third-year standing in physical therapy.* Staff

585 Physical Therapy Internship II *(II, 5)* Assignment to various clinical settings which provide supervised experiences with practicing physical therapists and support personnel. Specific setting and rotational time schedule is determined by the academic clinical coordinator and clinical staff. *Pre: 575, third-year standing in physical therapy, or permission of instructor.* Staff

590 General Practice Physical Therapy *(I, 3)* Problems and benefits associated with the business and conduct of different types of physical therapy private practice. Integration of the art and science of physical therapy with the delivery of services. *(Lec. 3) Pre: 418, 528, third-year standing in physical therapy.* Staff

595 Physical Therapy Internship III *(II, 5)* Assignment to various clinical settings which provide supervised experiences with practicing physical therapists and support personnel. Selection of clinical specialty area of student's interest is considered in determination of the setting. *Pre: 575, concurrent enrollment in 585, third-year standing in physical therapy, or permission of instructor.* Staff

Physics

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Surendra S. Malik, Ph.D., 1960, Agra University
Professor Jill C. Bonner, Ph.D., 1968, King's College, University of London
Professor J. Scott Desjardins, Ph.D., 1959, Columbia University
Professor Kenneth L. Hartt, Ph.D., 1963, University of Nebraska
Professor Charles Kaufman, Ph.D., 1963, Pennsylvania State University
Professor Stephen V. Letcher, Ph.D., 1964, Brown University
Professor Jan A. Northby, Ph.D., 1966, University of Minnesota
Professor Anthony C. Nunes, Ph.D., 1969, Massachusetts Institute of Technology
Professor William S. Penhallow, M.S., 1957, University of Maine
Professor Stanley J. Pickart, Ph.D., 1958, University of Maryland
Professor Albert Steyerl, Ph.D., 1971, Technische Universitat, Munich
Associate Professor Leonard M. Kahn, Ph.D., 1976, Brown University
Associate Professor Alexander E. Meyerovich, Ph.D., 1977, Institute of Physical Problems, U.S.S.R.
Associate Professor Gerhard Muller, Ph.D., 1980, University of Basel
Associate Professor M. Peter Nightingale, Ph.D., 1978, University of Amsterdam
Assistant Professor David R. Heskett, Ph.D., 1985, University of Pennsylvania
Adjunct Professor Frank W. Cuomo, M.S., 1961, The University of Rhode Island
Adjunct Professor Donald F. Kirwan, Ph.D., 1969, University of Missouri

Specializations

Acoustics and optics: underwater acoustics; acoustic imaging; ultrasonics; acousto-optical transducers; fiber optics.

Astronomy: astrometry; differential photometry.

Condensed matter theory: low-dimensional physics; statistical mechanics; magnetism; surface magnetism; Fermi liquids, spin-polarized helium and hydrogen, nonlocal hydrodynamics; chemisorption; superconductivity; alloys; hydrogen in metals.

Interdisciplinary physics: energy-related physics; climate modeling; computational physics; biophysics.

Liquid state: liquid crystals; liquid helium; ferrofluids, turbulence; superfluids.

Low-temperature physics: ionic mobilities; finite droplet effects; magnetic susceptibility; specific heats; magnetic cooling.

Neutron physics: ultra-cold neutrons; neutron optics.

Neutron scattering: small-angle scattering; solution scattering; surfaces and fine particles; crystal structure; amorphous magnets; inelastic scattering; phonons and spin waves.

Nuclear theory: inverse scattering studies; few-nucleon studies; hypernuclei; weak interactions.

Surface physics: electronic and structural properties of surfaces including phase transitions using LEEDS, AUGER, X-rays, and BNL Synchrotron Facility.

Master of Science

Admission requirements: GRE with advanced test; bachelor's degree with major in physics preferred.

Program requirements: PHY 510, 520, 530, 560, and 570 are required of all students. For the nonthesis option, the student shall complete 36 credits, with at least one course requiring a substantial paper involving significant independent study, and shall pass a final written and oral examination. For either option, no more than 6 credits in the program may be below the 500 level.

Doctor of Philosophy

Admission requirements: GRE with advanced test; bachelor's degree with major in physics preferred. Master's degree is not required.

Program requirements: PHY 510, 511, 520, 525, 530, 531, 560, 570, 571, 650, 660, and either 651 or 661. There is no formal departmental language requirement, although the candidate's committee may require demonstration of language proficiency. Successful completion of a qualifying examination is required of all students.

PHY Courses
Physics

401, 402 Seminar in Physics *(I and II, 1 each)*
410 Computational Physics *(II, 3)*
420 Introduction to Thermodynamics and Statistical Mechanics *(I, 3)*
425 Acoustics *(I, 3)*
451 Introduction to Quantum Mechanics *(I, 3)*
452 Quantum Mechanics: Techniques and Applications *(II, 3)*
455 Introduction to Solid-State Physics I *(I, 3)*
483, 484 (or AST 484) Laboratory and Research Problems in Physics *(I and II, 3 each)*
491, 492 (or AST 491, 492) Special Problems *(I and II, 1–6 each)*

510, 511 Mathematical Methods of Physics *(I and II, 3 each)* Definition of a vector, vector algebra and calculus, scalar and vector fields, linear vector operators, coordinate transformations, vector operations in curvilinear coordinates, dyadics, tensors, simple applications of the theory of finite groups. Partial differential equations of physics and their solutions, diffusion equation, wave equation, Schrodinger equation, Klein-Gordon equation, elements of the theory of probability. *(Lec. 3) Pre: permission of chairperson.* Staff

520 Classical Dynamical Theory I *(I, 3)* Lagrange's equations, holonomic and nonholonomic constraints, applications to dynamical systems, noninertial systems, alternate formulations of mechanics, theory of small vibrations, variational principles, Hamiltonian formulation of dynamics, canonical transformations. *(Lec. 3) Pre: credit or concurrent enrollment in 510.* Staff

525 Statistical Physics *(I, 3)* Probability distributions, information theory, ensembles in classical and quantum physics, partition functions, fluctuation and noise, statistics of identical particles. Applications to solids, liquids, and gases. *(Lec. 3) Pre: 420 or equivalent.* Staff

530 Electromagnetic Theory I *(II, 3)* Coulomb's law, Gauss' law, scalar potential, boundary value problems, multipole expansion, dielectrics, magnetic field due to stationary currents, scalar and vector potential, magnetic materials, Faraday's law, Lorentz force, conservation laws. Maxwell's equations. *(Lec. 3) Pre: 510.* Staff

531 Electromagnetic Theory II *(I, 3)* Scalar and vector wave equations and their solutions, retarded and advanced potentials. Lienard-Wiechert potentials, radiation from an arbitrarily moving charge, multipole radiation, wave guides, cavity resonators, plasma oscillations, theory of relativity. *(Lec. 3) Pre: 511 and 530.* Staff

560 Experimental Techniques in Condensed Matter Science *(I or II, 3)* Fundamentals of and selected topics in fields of research of interest to the department. Emphasis on gaining laboratory experience. *(Lec. 2, Lab. 2) Pre: 484 or equivalent.* Staff

570 Quantum Mechanics I *(II, 3)* Wave packets, Schrodinger equation, one-dimensional problems, hydrogen atom, harmonic oscillator, WKB approximation, operator formalism and matrix mechanics, angular momentum, perturbation theory, scattering and partial wave analysis, semiclassical treatment of the radiation field. *(Lec. 3) Pre: permission of chairperson.* Staff

571 Quantum Mechanics II *(I, 3)* Dirac equation, spin-orbit energy, theory of positrons, Feynman diagrams, Compton scattering, pair production, and bremsstrahlung. Second quantization and application to selected topics. *(Lec. 3) Pre: 570.* Staff

590, 591 Special Problems *(I and II, 1–6 each)* Advanced work under the supervision of a staff member arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

620 Quantum Statistical Mechanics *(II, 3)* Advanced statistical mechanics, density matrices, Ising and Heisenberg models. Application to theory of liquids, critical phenomena, percolation theory, and other areas of current research interest. *(Lec. 3) Pre: 525 or permission of instructor. In alternate years.* Staff

650, 651 Solid-State Physics *(I and II, 3 each)* Quantum theory of electrons, phonons, and other elementary excitations, Hartree-Fock approximation, many-body problem, superconductivity, band theory, and Fermi surface. *(Lec. 3) Pre: 455 or equivalent and 570. In alternate years.* Staff

660, 661 Nuclear Physics *(I and II, 3 each)* General properties of the nucleus. Two-body problem at low, intermediate, and high energy. Three- and four-body problems, nuclear forces, special models, nuclear spectroscopy and reactions, decay of nuclei, many-body problem, structure of nucleons. *(Lec. 3) Pre: 511 and 571. In alternate years.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

930 Workshop in Physics Topics for Teachers *(I, II, and SS, 0–3 each)* Especially designed for teachers of physical sciences. Basic topics in physics from an advanced or pedagogical perspective. *(Lec. or Lab.) Pre: teacher certification.* Staff

AST Courses
Astronomy

484 (or PHY 484) Laboratory and Research Problems in Physics *(I and II, 3)*
491, 492 (or PHY 491, 492) Special Problems *(I and II, 1–6 each)*

Plant Pathology–Entomology
M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Richard J. Hull, Ph.D., 1964, University of California
Professor Richard A. Casagrande, Ph.D., 1975; Michigan State University
Professor Noel Jackson, Ph.D., 1960, University of Durham
Professor Walter C. Mueller, Ph.D., 1961, Cornell University
Associate Professor Larry Englander, Ph.D., 1973, Oregon State University
Associate Professor Roger A. LeBrun, Ph.D., 1977, Cornell University
Associate Professor Patrick A. Logan, Ph.D., 1977, Michigan State University
Assistant Professor Steven R. Alm, Ph.D., 1985, Ohio State University
Adjunct Professor Arthur M. Kaplan, Ph.D., 1948, University of Massachusetts
Professor Emeritus Carl H. Beckman, Ph.D., 1953, University of Wisconsin

Specializations

Plant pathology: disease resistance mechanisms, fine structure of pathogen-host interactions, epidemiology of turfgrass and woody ornamental diseases. *Entomology:* insect ecology, pest management, aquatic biology. *Plant protection:* plant diseases, integrated pest management, and plant–insect interactions.

Master of Science

Admission requirements: GRE and undergraduate major in biological, agricultural, or physical sciences. Fundamental courses in biological sciences, mathematics, and chemistry may be required to make up deficiencies without graduate credit.

Program requirements: coursework as determined by graduate committee, three departmental seminars which include a final thesis seminar, and a thesis.

Doctor of Philosophy (Biological Sciences)

Limited to plant pathology specializations.

Admission requirements: GRE and preferably a master's degree in botany or plant pathology; other requirements same as master's degree; qualifying examination required if admitted without master's degree.

Program requirements: coursework as determined by graduate committee; dissertation.

For courses, see listing under Plant Science.

Plant Science
M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Richard J. Hull, Ph.D., 1964, University of California
Professor John J. McGuire, Ph.D., 1968, The University of Rhode Island
Professor Conrad R. Skogley, Ph.D., 1957, Rutgers—The State University
Associate Professor Dale T. Duff, Ph.D., 1967, Michigan State University
Associate Professor William R. Krul, Ph.D., 1967, Purdue University
Associate Professor Richard J. Shaw, Ph.D., 1966, University of Missouri
Associate Professor W. Michael Sullivan, Ph.D., 1981, University of Nebraska
Assistant Professor Joel Chandlee, Ph.D., 1984, North Carolina State University
Adjunct Assistant Professor Stephen L. Dellaporta, Ph.D., 1981, Worcester Polytechnic Institute

Specializations

Turfgrasses, woody ornamentals, and agricultural crops. Program emphasis may be developed in plant-soil nutrient relations, plant propagation including tissue culture, stress physiology, crop improvement, plant molecular biology, and the ecology of crop production. Additional areas include landscape ecology and floriculture. Specializations in soil science are available in the natural resources program.

Master of Science

Admission requirements: B.A. or B.S. degree with undergraduate courses in botany, agronomy or horticulture, chemistry, mathematics, physics, and soils passed with grades of A or B. Deficiencies in these areas must be corrected without grad-

uate program credit. GRE score (verbal and quantitative) totaling approximately 1000 or higher is expected. An area of interest corresponding to a field of program emphasis must be indicated. Applicants are encouraged to contact a faculty member in their area of interest who may be willing to serve as their major professor. Initial contact may be made with the chairperson of the Department of Plant Science.

Program requirements: Thesis and supporting study in botany, chemistry, plant science, and statistics as determined by the student and program committee. Three departmental seminars which include a final thesis seminar.

Doctor of Philosophy (Biological Sciences)

Admission requirements: GRE with a combined verbal and quantitative score of at least 1000 and, normally, an M.S. in an agricultural or biological science. Applicants who are admitted without an M.S. must pass a qualifying examination after earning 18–24 credits.

Program requirements: Comprehensive exams in one major and two minor areas chosen from agronomy, horticulture, soil science, crop ecology, plant biochemistry, crop physiology, soil biology, anatomy–morphology, taxonomy–systematics, and genetics (one of the first three areas must be included). Demonstration of sufficient knowledge to teach an introductory plant science course and competence in one research tool selected from experimental statistics, computer science, electron microscopy, and analytical chemistry. Substitution of a foreign language for the requirement of an additional research tool may be specified by the student's committee. Dissertation.

PLS Courses
Plant Sciences

401, 402 Plant Sciences Seminar *(I and II, 1 each)*
405 Propagation of Plant Materials *(II, 3)*
415 Theories and Practices in Therapeutic Horticulture *(II, 3)*
436 Floriculture and Greenhouse Crop Production *(II, 4)*
440 Diseases of Turfgrasses, Trees, and Ornamental Shrubs *(II, 3)*
441 Plant Disease Laboratory *(I, 1)*
442 Professional Turfgrass Management *(II, 3)*
461 Weed Science *(I, 3)*
463 Principles of Plant Disease Control *(II, 3)*
465 Etiology of Plant Disease *(I, 3)*
471 Plant Improvement I *(I, 3)*
472 Plant Improvement II *(II, 3)*
475 (or NRS 475) Plant Nutrition and Soil Fertility *(II, 4)*
482 Origin and Adaptation of Shade and Ornamental Trees *(II, 3)*
491, 492 Special Projects and Independent Study *(I and II, 1–3 each)*

501, 502, 503, 504 Graduate Seminar in Plant Sciences *(I and II, 1 each)* Presentation of technical reports and discussion of current research papers in crop science, landscape ecology, growth and development of economic plants, and production, protection, and management of economic crops. *(Lec. 1) Pre: permission of instructor.* Staff

511 The Nature of Plant Disease *(I, 3)* Analysis of the nature of plant disease, the processes of infection and pathogenesis, and the structural and physiological responses that determine resistance to disease. *(Lec. 3) Pre: BOT 332 or equivalent. In alternate years. Next offered 1989–90.* Staff

512 Plant Growth and Development *(II, 4)* Environmental, chemical, and genetic regulation of plant development, from seed formation to senescence. *(Lec. 3, Lab. 3) Pre: BOT 245. In alternate years, next offered 1989–90.* Krul

513 Laboratory Plant Tissue Culture *(II, 1)* Techniques for initiation and continuous culture of plant cells; protoplast isolation, fusion, and selection; micropropagation, somatic embryogenesis, and production of haploid plants via pollen and anther culture. *(Lab. 3) Pre: BOT 245, concurrent enrollment in 472, and permission of instructor. In alternate years. Next offered 1989–90.* Krul

529 Systems Science for Ecologists *(I, 3)* Concepts and techniques for computer analysis and simulation of complex biological systems. *(Lec. 3) Pre: 141, BOT 262, or permission of instructor.* Logan

555 (403) Insect Pest Management *(II, 3)* Evaluation of past and present pest-control strategies in light of insect ecology. Development of pest-management systems emphasizing biological control, resistant plants, and ecosystem redesign. *(Lec. 3) Pre: 200 or 385 or permission of instructor.* Casagrande

561 Aquatic Entomology *(I, 3)* Biology of insects in aquatic environments, including systematics, morphology, and ecology. Field trips emphasize species/habitat relations and the role of insects in aquatic management programs. *(Lec. 2, Lab. 3) Pre: 385 or permission of instructor.* LeBrun and Logan

571 Plants, Insects, and Pathogens *(II, 3)* A two-part investigation of insect-microbe associations, concentrating on the comparative pathobiology of microbial agents in the insect host and the transmission of plant disease organisms by the insect vectors. *(Lec. 3) Pre: 381 and MIC 211, or permission of instructor. In alternate years. Next offered 1990–91.* LeBrun

572 (or BCP 572) Plant Biochemistry *(I, 3)* Physiological chemistry unique to plants. Emphasis on energy acquiring, transferring, and storing reactions including the metabolism of carbohydrates, amino acids, lipids, phenolics, and phytohormones. *(Lec. 3) Pre: BCP 311 or 581 or permission. In alternate years. Next offered 1989–90.* Hull

576 Physiology of Plant Productivity *(I, 3)* Critical analysis of contemporary views on energy conversion and transformation in primary plant production. Topics include photosynthesis, phosphorylation, photorespiration, transport mechanisms, nitrogen assimilation, and symbiosis. *(Lec. 3) Pre: organic chemistry, plant physiology, biochemistry, or permission of instructor. In alternate years. Next offered 1990–91.* Hull

591, 592 Nonthesis Research in Plant Sciences *(I and II, 1–3 each)* Advanced work under the supervision of research staff to expand research experience into areas other than those related to thesis research. Arranged to suit individual requirements. *(Lab. 3–9) Pre: permission of instructor.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Note: for other related courses see BOT 332, 432, 446, 453, 521, 524, 554, MIC 552, and ZOO 381, 581, 586.

Political Science

M.A., M.P.A.

Graduate Faculty

Chairperson: Professor Timothy M. Hennessey, Ph.D., 1968, University of North Carolina
Professor Alfred G. Killilea, Ph.D., 1969, University of Chicago
Professor Edgar C. Leduc, Ph.D., 1963, Indiana University
Professor Josephine F. Milburn, Ph.D., 1956, Duke University
Professor Lawrence Rothstein, Ph.D., 1976, University of Massachusetts
Professor Arthur Stein, Ph.D., 1965, University of Pennsylvania
Professor David D. Warren, Ph.D., 1959, Fletcher School of Law and Diplomacy
Professor Stephen B. Wood, Ph.D., 1964, University of Chicago
Professor Norman L. Zucker, Ph.D., 1960, Rutgers—The State University
Associate Professor Gerry R. Tyler, Ph.D., 1972, Yale University

Specializations

American government, public policy, public law, international relations, comparative politics, politics of the developing areas, public administration, political theory.

Master of Arts

Admission requirements: GRE with undergraduate credit in basic political science and political theory.

Program requirements: M.A. has a thesis and nonthesis option; nonthesis option requires one course including a substantial paper requiring significant independent research and an oral examination in addition to comprehensive examination. An interdisciplinary program involving 15 additional credits in related fields leads to a Graduate Certificate in International Development Studies. See International Studies on page 60 for details.

Master of Public Administration

Admission requirements: generally, GRE with 1000 score (verbal plus quantitative) and undergraduate credit in basic political science.

Program requirements: nonthesis—one course including a substantial paper requiring significant independent research; comprehensive examination; internship; minimum total of 36 credits including PSC 501, 502, 503, 505, 506, and 524. Competency in computer science and statistics is required and may be demonstrated by completion of a basic course at the undergraduate level.

Cooperative Program (M.P.A. and M.L.I.S.)

A cooperative program permits joint enrollment in the Master of Library and Information Studies and the Master of Public Administration programs, each of which requires a minimum of 36 credits when taken separately. The integrated pursuit of the two degrees makes it possible for 9 credits of appropriately selected coursework from one program to serve as electives in the other, and for 6 credits of such coursework to be applied in the opposite direction. Thus, when planned and taken jointly, the two programs can be completed with a total of 57 credits.

Admission requirements: GRE and other requirements listed for M.L.I.S. and M.P.A. Applicant must apply and be accepted in both programs. Applications (in quadruplicate) must indicate M.L.I.S./M.P.A. as the field of specialization.

Program requirements: Each student must complete the required core courses for both programs plus 3 credits of PSC 590 for the M.P.A. and 3 credits chosen from LSC 520, 521, 522, or 533 for the M.L.I.S. Students must file separate programs of study for each degree, indicating the courses to be jointly counted. Each student must pass the separate comprehensive examination for each degree. A student who fails to complete one of the programs may, of course, complete the other in accordance with the separate program of study.

PSC Courses
Political Science

401 Comparative European Politics *(I and II, 3)*
407 The Soviet Union: Politics and Society *(II, 3)*
408 African Government and Politics *(I, 3)*
410 (or AAF 410) Issues in African Development *(I or II, 3)*
420 Nonviolence and Change in the Nuclear Age *(I, 3)*
422 Comparative American State Politics *(II, 3)*
431 International Relations *(I, 3)*
432 International Government *(II, 3)*
434 American Foreign Policy *(II, 3)*
440 The Politics of Being Mortal *(I or II, 3)*
443 Twentieth-Century Political Theory *(I, 3)*
444 Marxist Political Thought *(II, 3)*
455, 456 Directed Study or Research *(I and II, 3 each)*
461 The American Presidency *(I, 3)*
464 International Law *(II, 3)*
466 Urban Problems *(II, 3)*
471 Constitutional Law *(I, 3)*
472 Civil Liberties *(II, 3)*
474 Criminal Justice Systems *(II, 3)*
481, 482 Political Science Seminar *(I and II, 3 each)*
483 Political Process: Policy Formulation and Execution *(I or II, 3)*
486 Cooperative Communities *(II, 3)*
491 Principles of Public Administration *(I, 3)*
495 Comparative Urban Politics *(I, 3)*
498 Public Administration and Policy Formulation *(II, 3)*

501 Administrative Theory *(I and II, 3)* Theoretical constructs and models in fields of public administration; theories of Weber, Riggs, Dorsey, Simon, Presthus. Lower-level models in subfields of organization, communications, and decision making. Task-oriented subject matter such as personnel, budget, and program administration related to theoretical formulations which seek to explain them. *(Sem. 3) Pre: 491 or permission of chairperson.* Hennessey

502 Techniques of Public Management *(I and II, 3)* Principles and techniques employed in the administration of staff activities of the public service, such as administrative planning, project scheduling, and budgeting. *(Sem. 3) Pre: 491 or permission of chairperson.* LeDuc

503 Problems in Public Personnel Administration *(I or II, 3)* Development of personnel administration, including problems of recruitment, examination, promotion, and staffing within public service. Emphasis on evaluation of employee performance and collective bargaining in public service. *(Sem. 3) Pre: graduate standing or permission of chairperson.* Staff

505 (or SOC 505) Public Program Evaluation *(II, 3)* Research design and methodologies associated with the evaluation of governmental programs and activities. *(Sem. 3) Pre: EST 308 or equivalent or permission of instructor.* Leduc and Hennessey

506 Seminar in Budgetary Politics *(I, 3)* Examination of federal, state, and local fiscal and budgetary processes, focusing on the politics of the budgetary process and models of budgeting, with emphasis on contemporary issues. *(Sem. 3)* Staff

512 Seminar in Marine Science Policy and Public Law
See Marine Affairs 512.

521 International and Comparative Trade Unions and Labor Relations
See Labor Studies 521.

522 Comparative American Local Politics *(I, 3)* Comparative study of American local government and politics. Emphasis on the determinants of local public policy. *(Sem. 3) Pre: 221 or urban-related course and EST 308.* Leduc

523 Seminar in Comparative Public Administration *(I, 3)* Theory, practice, and organization of selected European and developing nations' administrative systems. Analysis of selected policies. Influence of English and French systems on developing systems. Structure-function and ecological analysis. *(Sem. 3) Pre: 491, 501, or permission of instructor.* Milburn

524 Seminar in Public Policy Problems *(I and II, 3)* In-depth exploration of selected problems of policy formulation—intergovernmental relations, regionalization, citizen participation and control, priority setting for public sector programs. *(Sem. 3) Pre: 491, 501, or permission of chairperson.* Hennessey

544 Democracy and Its Critics *(I, 3)* Seminar examining the roots of modern democracy in the social contract theories and analyzing the quality and limits of self-determination in these theories in the light of contemporary politics. *(Sem. 3) Pre: 341, 342, or permission of chairperson.* Killilea

546 Alternative Prospects for Humanity *(II, 3)* Exploration of range of possibilities for humankind over next several decades. Emphasis on approaches oriented towards improving our prospects for survival, social justice, and holistic growth. *(Sem. 3) Pre: 420 or 486.* Stein

555, 556 Directed Study or Research *(I and II, 3 each)* Special work arranged to meet the individual needs of graduate students in political science. *(Sem. 3) Pre: permission of chairperson.* Staff

568 Jurisprudence *(II, 3)* Introduction to the philosophy of law, treating the sources, the nature, and the consequences of major systems of legal thought. Emphasis on the relationship between legal reasoning and judicial decision making in the United

States. *(Sem. 3) Pre: 471, 472, or permission of instructor. In alternate years. Next offered 1989–90.* Wood

573 Administrative Law *(I, 3)* Legal aspects of interaction between government agencies, individuals, and public interest groups. Systematic analysis of leading cases, evaluating the courts as an instrument for protecting the individual's rights in administrative action. *(Sem. 3) Pre: 113.* Rothstein

577 International Ocean Law
See Marine Affairs 577.

590 Internship in Public Administration *(I and II, 3–6)* Participation at an administrative agency under supervision of agency head and a faculty member. Planning, personnel management, research organization, budgeting, interdepartmental relations, informal liaisons that are the hallmark of effective administration. *Pre: permission of chairperson. May be taken as one 6-credit unit or two 3-credit units.* Staff

595 Problems of Modernization in Developing Nations
See Resource Economics 595.

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Psychology

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Nelson F. Smith, Ph.D., 1963, Princeton University
Professor Allan Berman, Ph.D., 1968, Louisiana State University
Professor Henry B. Biller, Ph.D., 1967, Duke University
Professor Jerry L. Cohen, Ph.D., 1973, University of Illinois
Professor Lawrence C. Grebstein, Ph.D., 1964, University of Kentucky
Professor Ira Gross, Ph.D., 1967, University of Illinois
Professor Janet Kulberg, Ph.D., 1967, George Peabody College
Professor Albert J. Lott, Ph.D., 1958, University of Colorado
Professor Bernice Lott, Ph.D., 1954, University of California, Los Angeles
Professor James O. Prochaska, Ph.D., 1969, Wayne State University
Professor Albert Silverstein, Ph.D., 1963, University of California
Professor John F. Stevenson, Ph.D., 1974, University of Michigan
Professor Wayne F. Velicer, Ph.D., 1973, Purdue University
Professor William T. Vosburgh, Ph.D., 1965, Syracuse University
Professor Alan Willoughby, Ph.D., 1959, University of Connecticut
Associate Professor Susan A. Brady, Ph.D., 1975, University of Connecticut
Associate Professor Charles E. Collyer, Ph.D., 1976, Princeton University
Associate Professor Paul R. Florin, Ph.D., 1981, George Peabody College of Vanderbilt University
Associate Professor Kathryn Quina, Ph.D., 1973, University of Georgia
Associate Professor Dominic Valentino, Ph.D., 1971, University of California
Assistant Professor Lisa Lavoie Harlow, Ph.D., 1985, University of California, Los Angeles
Assistant Professor Patricia J. Morokoff, Ph.D., 1980, State University of New York, Stony Brook
Research Assistant Professor Joseph S. Rossi, Ph.D., 1984, The University of Rhode Island
Assistant Professor W. Grant Willis, Ph.D., 1984, University of Georgia
Adjunct Professor David Abrams, Ph.D., 1981, Brown University
Adjunct Professor John J. Colby, Ph.D., 1974, The University of Rhode Island
Adjunct Professor Edith Kaplan, Ph.D., 1968, Clark University
Adjunct Associate Professor Donna Cone, Ph.D., 1982, Emory University
Adjunct Associate Professor James P. Curran, Ph.D., 1970, University of Illinois
Adjunct Associate Professor Fredric Friedman, Ed.D., 1977, Boston University
Adjunct Associate Professor Gerald Groden, Ph.D., 1963, Purdue University
Adjunct Associate Professor Eugene Knott, Ph.D., 1974, University of Maryland
Adjunct Associate Professor Thomas M. Lasater, Ph.D., 1969, University of Houston
Adjunct Associate Professor Peter Monti, Ph.D., 1974, The University of Rhode Island
Adjunct Associate Professor Ronald Paolino, Ph.D., 1963, Purdue University
Adjunct Associate Professor Roger Richardson, Ph.D., 1967, Louisiana State University
Adjunct Associate Professor Michael A. Young, Ph.D., 1974, Adelphi University
Adjunct Assistant Professor Alice Brown-Collins, Ph.D., 1982, University of Colorado
Adjunct Assistant Professor Glenn Cahn, Ph.D., 1980, California School of Professional Psychology
Adjunct Assistant Professor Gerald Champagne, Ph.D., 1979, The University of Rhode Island
Adjunct Assistant Professor George J. DuPaul, Ph.D., 1985, The University of Rhode Island
Adjunct Assistant Professor Bette LaSere Erickson, Ed.D., 1976, University of Massachusetts
Adjunct Assistant Professor Grace E. Frenzel, Ph.D., 1979, Colorado State University
Adjunct Assistant Professor June Groden, Ph.D., 1981, Boston College
Adjunct Assistant Professor Katherine C. Haspel, Ph.D., 1981, The University of Rhode Island
Adjunct Assistant Professor Lorraine H. Huckel, Ph.D., 1984, The University of Rhode Island
Adjunct Assistant Professor Daniel Hurley, Jr., Ph.D., 1976, University of Maryland
Adjunct Assistant Professor Susan S. Kirschenbaum, Ph.D., 1985, The University of Rhode Island
Adjunct Assistant Professor R. Craig Lefebvre, Ph.D., 1981, North Texas State University
Adjunct Assistant Professor Stephen Neill, Ph.D., 1982, The University of Rhode Island
Adjunct Assistant Professor Ted D. Nirenberg, Ph.D., 1980, University of North Carolina
Adjunct Assistant Professor Kevin Plummer, Ph.D., 1983, The University of Rhode Island
Adjunct Assistant Professor Patricia Raymond, Ph.D., 1981, The University of Rhode Island
Adjunct Assistant Professor Mary Weyhing, Ph.D., 1983, The University of Rhode Island
Adjunct Assistant Professor Ann S. Zartler, Ph.D., 1978, The University of Rhode Island
Professor Emeritus Peter F. Merenda, Ph.D., 1957, University of Wisconsin

Specializations

Programs are offered in clinical, experimental, and school psychology. Specializations are offered within each program. The clinical program encourages students to organize their courses so as to foster their developing career needs. Thus, one is encouraged to develop specific interests and competencies in such areas as family systems, substance abuse, child/clinical, community, neuropsychology, individual intervention, and general clinical practices. Students in the experimental program tend to concentrate in one of the following five areas: 1) human perception and learning; 2) conditioning and behavior change; 3) psychophysiology; 4) methodology and quantitative psychology; and 5) personality/social/community basis of behavior. Additional individual specialties can be developed within each of the program areas.

Master of Science (School Psychology Only)

Admission requirements: GRE with advanced test. Undergraduate major in psychology recommended. Applicants are admitted for September only. Applications must be completed by February 15.

Program requirements: nonthesis—internship; total of 60 credits with a minimum of 30 for the master's degree plus additional credits for certification as a school psychologist; one course with major

paper involving significant independent research; and a written comprehensive examination.

Doctor of Philosophy (Clinical, Experimental, and School Psychology)

Admission requirements: GRE with advanced test; evidence of research competency. Applicants are admitted for September only. Applications must be completed by February 1 for clinical, by February 15 for school, and by March 15 for experimental. Prospective applicants are asked to address initial inquiries concerning the desired specialization to the department, but formal application materials must be obtained from and returned directly to the Graduate School Office. Applicants to the clinical program are evaluated on the basis of previous academic achievement, GRE scores, previous life experience, previous applied clinical and research experience, letters of recommendation, personal interview, and projected balance between applicant and program needs.

Due to limited facilities, new admissions to the doctoral programs must be limited to a small number per year. Finalists in the school and clinical specialization must participate in a personal interview to complete the evaluation process. Although test scores and cumulative averages are not the sole criteria for admission, those with overall quality point averages of less than 3.00 on a 4.00 scale, or whose two highest GRE scores do not total above 1200, are advised that there is little chance for admission.

Program requirements: completion of a minimum of 90 credits (72 plus 18 for dissertation). Language requirement optional depending on requirements set forth by student's program committee. Research course requirements—a minimum of 2 courses in statistics (PSY 510/532) and a research methods course (PSY 611). The research competency requirement may be met by successfully defending a master's thesis or by successfully completing a research competency project under the direction of the major professor. The research competency project option is limited to those who have nonthesis master's degrees in psychology. Students who successfully complete the thesis option will earn a Master of Arts degree in psychology. A Ph.D. qualifying examination is required of all doctoral students entering without the master's degree. This requirement is met by completing four core courses from PSY 532, 533, 611, and those numbered 601–609, with a grade of B or better. These courses are usually completed prior to earning 24–30 credits. For students in the applied areas (clinical and school) at least one core course must be completed in each of the following content areas of psychology: biological bases of behavior; cognitive and affective bases; social bases; individual differences; and history and systems of psychology.

The objective of our Ph.D. program is to give our students the knowledge and skills they will need to be effective psychologists in their chosen area. Scientific training and research experience as well as knowledge and technical skills are a part of each student's program, but his or her program is individually designed around his or her needs and goals.

Both the clinical and school psychology programs are accredited by the American Psychological Association. Both programs subscribe to the scientist-practitioner model, and thus course requirements are consistent with maintaining such accreditation. Practicum and individual research projects can be specifically tailored to help the student prepare for the professional role of his or her choice. These programs also have a strong experiential base including field activity in each year. Students are expected to be involved in research for a substantial portion of their program.

The department emphasizes a close working relationship between faculty and students. No single theoretical or philosophical model is espoused.

PSY Courses
Psychology

432 Advanced Developmental Psychology *(II, 3)*

434 Psychological Testing *(I or II, 3)*

436 (or PCL 436) Psychotropic Drugs and Therapy *(II, 3)*

442 The Exceptional Individual *(I and II, 3)*

450 Cognitive and Behavioral Analysis of Communication *(II, 3)*

454 Group Processes *(I, 3)*

456 Research Methods in Social Psychology *(II, 4)*

460 The Substance-Troubled Person *(I, II, and SS, 3)*

464 Humanistic Psychology *(II, 3)*

465 Introduction to Crisis Intervention *(I or II, 3)*

470 Topics in Social Psychology *(I, 3)*

471 Applied Behavioral Analysis and Remediation *(II, 3)*

473 Practicum in Behavioral Psychology *(I or II, 3)*

479 Contemporary Problems for Modern Psychology *(I and II, 3–12)*

480 The Female Experience *(II, 3)*

489 Problems in Psychology *(I and II, 3)*

499 Psychology Practicum *(I and II, 1–6)*

505 Community Psychology *(I, 3)* Introduction to community psychology; study and change of individual's interaction with community systems; theoretical and empirical models, intervention strategies, and research methods relevant to community psychology. *(Lec. 3) Pre: permission of chairperson.* Stevenson

517 (or EST 517) Small N Designs *(II, 3)* A survey of Small N experimental methodology, including hypothesis of quasi-experimental designs and the application of interrupted time series. Applications in applied research, particularly behavioral intervention. *(Lec. 3) Pre: 533 (510) and 532. In alternate years.* Velicer

520 Mental Measurement and Test Theory *(I or II, 3)* Study of statistical and theoretical background relevant to mental test scores. Principals of test construction. Controversies and current developments in measurement and psychometrics. *(Lec. 3) Pre: 434.* Harlow and Staff

522 Behavioral Assessment Techniques *(II, 3)* Interview, observational, questionnaire, self-monitoring, cognitive behavior modification, and analogue assessment procedures are reviewed in terms of their use and interpretation of behavior in clinical, institutional, home, and school settings. *Pre: 434 and 550. Offered in odd calendar years.* Staff

532 Experimental Design
See Experimental Statistics 532.

533 (510) Advanced Quantitative Methods in Psychology *(II, 3)* Advanced quantitative methods applied to psychology. Survey of methods such as multiple regression, multivariate analysis of variance, discriminate analysis, canonical correlation, principal component analysis, and factor analysis. Applications involve BMDP, SAS, or SSPS computer programs. *(Lec. 3) Pre: 532 or permission of chairperson.* Velicer or Harlow

534 Structured Personality Assessment *(II, 3)* Review of reliability, validation, and instrument construction methods for personality assessment. Critical evaluation of established (MMPI, Edwards, PRF) and recent tests. Development and interpretation of individualized evaluations based on profile analysis. *(Lec. 3) Pre: 434 or equivalent.* Velicer and Staff

540 (or EDC 540) Learning Disabilities: Assessment and Intervention *(SS, 3)* Applications of early screening batteries; remedial programs for various disabilities, developing treatment exercises, behavioral programs, and programs for older children and adolescents. Emphasis on pragmatic application of skills for detection and treatment. *(Lec. 3) Pre: permission of instructor. May be repeated as A and B for a maximum of 6 credits.* Berman

544 The Psychological Bases for Reading Disorders *(I or II, 3)* An in-depth review of research on factors related to reading ability. Topics include linguistic requirements, perceptual and neurological factors, implications for screening and instruction. *(Lec. 3) Pre: graduate standing or permission of instructor.* Brady

550 Operant Analysis of Behavior *(I or II, 3)* Introduction to the principles of operant conditioning with emphasis on the use of these principles in the analysis of behavior. *(Lec. 3) Pre: permission of chairperson.* Smith

554 Alternate Therapies *(I or II, 3)* Theory and practice of those individual and group techniques which can be integrated into one's present style of helping: a) existential, b) body therapies, c) cognitive therapies, and d) other contemporary approaches. Students may participate in a maximum of five distinct workshops. *(Lec. 2, Lab. 2) Pre: professional and/or graduate standing and permission of the coordinator.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

601 Physiological Psychology *(II, 3)* An advanced consideration of physiological research on neural, endocrine, and response systems as they relate to attention, motivation, emotion, memory, and psychological disorders. *(Lec. 3) Pre: permission of chairperson.* Valentino

602 Learning and Motivation *(II, 3)* Empirical and theoretical analysis of the basic principles of acquisition and loss of habits. Topically organized to deal with respondent and operant conditioning, and their relationship to reinforcement and motivation. *(Lec. 3) Pre: undergraduate learning course and permission of chairperson.* Silverstein and Staff

603 Development *(II, 3)* Theoretical, methodological, and applied issues in lifespan development, including cognitive, perceptual, psychomotor, affective, and social development. Topically organized. *(Lec. 3) Pre: permission of chairperson.* Kulberg, Biller, and Staff

604 Cognitive Psychology *(I, 3)* A survey of the theoretical and methodological issues in human cognition. Topics include pattern recognition, attention, memory, language, problem solving. *(Lec. 3) Pre: permission of chairperson.* Brady and Staff

605 Personality *(I or II, 3)* Reading of primary source materials from major personality theorists relevant to a particular topical emphasis. Application and comparative evaluation of the theories studied. *(Lec. 3) Pre: permission of chairperson.* Stevenson and Staff

606 Social Psychology *(I, 3)* Intensive exploration of the methods, theory, and database of contemporary social psychology focusing on salient issues that clarify significant topics in this area. *(Lec. 3) Pre: permission of chairperson.* A. Lott and Staff

607 Advanced Psychopathology *(I or II, 3)* Empirical literature with regard to etiological factors involved in the formation of pathological character trends and deviations. Evaluation of clinical theory and classification systems as related to the psychotherapeutic process. *(Lec. 3) Pre: permission of chairperson.* Grebstein and Staff

608 Theories and Systems *(I, 3)* An in-depth analysis of the origin and logical structure of major systematic approaches to psychology. Emphasis on significant recurrent controversies. *(Lec. 3) Pre: graduate standing.* Collyer or Silverstein

609 Perception *(I or II, 3)* A survey of topics in the psychology of perception, including sensory function, psychosocial models, measurement, and scaling; visual perception; and methods for analyzing perceptually guided behavior. *(Lec. 3) Pre: permission of chairperson.* Collyer

610 (or EST 610) Parsimony Methods *(I, 3)* Multivariate procedures designed to reduce the dimensionality and help in the interpretation of complex data sets. Methods include principal components analysis, common factor analysis, and image analysis. Related methods: cluster analysis and multidimensional scaling. Applications involve the use of existing computer programs. *(Lec. 3) Pre: 533 or EST 541 or equivalent. In alternate years. Next offered 1990–91.* Velicer

611 Methods of Psychological Research and Experimental Design *(I, 3)* Provides the student of psychology with a knowledge of research methodology and the techniques of experimental designs. It prepares for the development of thesis problems of graduate students in psychology and related disciplines. *(Lec. 3) Pre: 533 (510) and 532.* Staff

612 (or EST 612) Structural Modeling *(II, 3)* Theory and methodology of path analysis with latent variables. Discussion of "causation" and correlation, Confirmatory Factor Analysis, Measurement and Structural Equation models. Practical applications utilizing LISREL, EQS, and PLS computer programs. *(Lec. 3) Pre: 533 or 610.* Harlow and Velicer

615 Collaborative Research in Psychology *(I or II, 0–3)* Collaborative approaches to psychological research. Special emphasis on topics that can involve students at varying levels of research skill. Format includes weekly topical seminar and biweekly colloquium combining all topical interest groups. *(Sem. 3, Colloquium 1) Pre: 300, 301, 532, or equivalent and permission. May be repeated for a maximum of 6 credits. S/U credit.* Kulberg and Staff

620 Seminar: Classical Conditioning *(I and II, 3)* History and nature of the conditional reflex, with emphasis placed on understanding the role of the conditional reflex and contemporary behavioral research and theory. *(Lec. 3) Pre: permission of chairperson.* Smith

621 Seminar: Human Learning and Memory *(I or II, 3)* Experimental analysis of major problem topics of learning and retention studies in humans. Emphasis on systematic studies of verbal habits, dimensional analysis of the critical variables influencing these habits, and the interference theory of forgetting. *(Lec. 3) Pre: permission of chairperson.* Silverstein

625 Seminar: Social Psychology *(II, 3)* Emphasis on a major area in contemporary social psychology. Empirical studies analyzed for their relevance to theoretical and applied issues; students will design an original investigation. *(Sem. 3) Pre: graduate standing or permission of instructor. May be repeated for a maximum of 6 credits with different topic.* A. Lott, B. Lott, J. Cohen, and J. Stevenson

641 Introduction to Psychotherapy *(I, 3)* A transtheoretical analysis of the major systems of psychotherapy. Developing an integrative, eclectic model through identifying the processes of change that are the core of effective therapy. *(Lec. 3) Pre: permission of chairperson.* Prochaska

644 Family Therapy *(I, 3)* Introduction to theories and techniques of family assessment and family therapy. Seminar format with videotape illustrations, case presentation and discussion, role playing, lecture, and selected experiential exercises. *(Lec. 3) Pre: permission of instructor.* Grebstein

645 Marital and Sexual Therapy *(I, 3)* Behavioral, psychodynamic, and systems perspective on marital and sexual problems and treatments. Theory and research applied in supervised practice with troubled couples. *(Lec. 3) Pre: permission of chairperson.* Prochaska

646 Group Therapy *(I, 3)* Theory, research, and change strategies developed in working with small groups. Current research, models, and techniques will be discussed in the context of actual clinical work with groups. *(Lec. 3) Pre: permission of instructor. In alternate years.* Grebstein

647 Child Therapy *(I, 3)* Seminar discusses issues, techniques, and research related to behavior changes in children and their families. Aspects of therapy, the role of behavioral approaches, and the participation of parents will be explored. Direct, supervised experience is included in this course. *(Lec. 3) Pre: participation in the Psychological Consultation Center and permission of chairperson.* Staff

661 Psychological Services I: Administration and Interpretation of Cognitive Tests *(I, 3)* Instruction and practice in administration and interpretation of cognitive tests; individual intelligence tests of both general and specific abilities. Rationale, research evidence, clinical application of Stanford-Binet, Wechsler, McCarty scales. *(Lec. 3) Pre: permission of chairperson.* Berman and Willis

662 Psychological Services II: Administration and Interpretation of Personality Tests *(II, 3)* Instruction and practice in the administration and interpretation of instru-

ments used in the assessment of personality. Emphasis on projective tests such as Rorschach, TAT. Rationale, research evidence, and clinical application. *(Lec. 3) Pre: permission of chairperson.* Berman and Staff

664 Advanced Diagnostic Problems *(II, 3)* Use and interpretation of cognitive, projective, and neural psychological tests. Focus on integrating data into meaningful description of total personality functioning. Use of the diagnostic interview. *(Lec. 3) Pre: 661, 662, and permission of instructor. In alternate years.* Berman

665 Seminar: Behavior Disorders in Childhood *(I or II, 3)* Emphasis on etiological factors, diagnostic and treatment consideration, and experimental research findings related to the psychological maladjustments in infancy and childhood; treatment procedures, resources and methods used in dealing with behavior and personality problems. Lectures, discussions, and case demonstrations. *(Lec. 3) Pre: 660. In alternate years. Next offered 1989–90.* Berman

666 Seminar: Ethical and Legal Issues in Psychology *(I or II, 3)* Ethical, legal, and professional issues as they relate to the provision of psychological services and psychological research. Emphasis is on the study of ethical issues and the examination of the development of professional standards as they relate to the areas of clinical psychology practice, school psychology practice, and applied research practice. *(Sem. 3) Pre: permission of chairperson.* Mitchell and Staff

668 School Psychological Consultation *(II, 3)* Historical and contemporary perspectives on consultation are discussed in terms of mental health and psychoeducational services. The focus is on the content and process of consultation in various clinical and educational settings. *(Sem. 3) Pre: 666 or equivalent.* Staff

670 Field Experience in Psychological Services *(I and II, 1–12)* Training placements and internships are available in a variety of institutional agencies and school settings under supervision which must be acceptable to the department: (a) school, (b) experimental areas, (c) clinical. *Pre: permission of chairperson. S/U credit.* Staff

672 Individual Clinical Practicum *(I or II, 3–9)* Introductory experience in dealing with clinical problems in a variety of clinical settings. Individual supervision to be arranged. *(Lec. 3) Pre: 661, 662, and permission of chairperson. May be repeated for a maximum of 9 credits. S/U credit.* Staff

673 Seminar: Introduction to Clinical Psychotherapy *(I, 3)* Theories and techniques of psychotherapeutic procedures involving directive and nondirective and play therapies. Theoretical rationale and empirical research with special emphasis on the child area. *(Lec. 3) Pre: permission of chairperson.* Staff

674 Clinical Practices: Therapy *(I or II, 3–12)* Specialized techniques of clinical interviewing, counseling, and psychotherapy. Critical discussions of student's own supervised therapy sessions: a) individual, b) behavior, c) sensitivity, d) specialized techniques. *(Lec. 3) Pre: 640, 660, 673, and permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

675 Experimental Psychopathology *(I or II, 3)* Relates recent experimental methodology and findings to prevalent theoretical positions. Emphasis on reviewing experimental literature in specialized clinical areas. *(Lec. 3) Pre: permission of chairperson.* Prochaska

676 Neurological Correlates of Psychopathology *(II, 3)* Functioning and physiology of the central nervous system with particular attention to determining how neurological disruption and injury are manifested in behavioral disorder. Techniques used to evaluate and interpret neuropsychological functioning. *(Lec. 3) Pre: permission of instructor. In alternate years. Next offered 1989–90.* Berman

680 School Practices I: Diagnostic *(I and II, 3–9)* Testing procedures and devices in the diagnosis of organicity, personality problems, special learning problems, visual, auditory, and memory problems; includes administration, interpretation, and special adaptation of tests in the school situation. *(Lec. 3) Pre: 434, 661, or permission of chairperson. May be repeated for a maximum of 9 credits.* Staff

681 Special Problems in School Psychology *(I or II, 3–9)* Role of the psychologist in the school setting. Several theoretical and practical issues concerned with the value of psychological theory, administrative philosophy, and school organization are explored. *(Lec. 3) Pre: 680 and permission of chairperson. May be repeated for a maximum of 9 credits.* Vosburgh and Staff

683 Psychology of the Exceptional Child *(I, 3)* Social, psychological, and educational factors that constitute the matrix of concerns with the exceptional individual in the school and community. Recent innovations in public and private education and habilitation. Research issues and legislation discussed evolve into student studies. *(Lec. 3) Pre: permission of chairperson.* Gross

687 Seminar: Topics in the Psychology of the Exceptional Individual *(I or II, 3)* Survey of topics and current issues in the treatment, needs, and understanding of the psychology of specific exceptionalities. *Pre: 683. May be repeated for a maximum of 9 credits with different topics.* Staff

690 Seminar: Contemporary Issues in Psychology *(I and II, 3–12)* Recent developments and current issues. Rigorous exploration of experimental and theoretical literature. Study limited each semester to one of the following areas: developmental, clinical, motivation, perception, psychophysics, and scaling problem solving and thinking. *(Lec. 3) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

692, 693 Directed Readings and Research Problems *(I or II, 3–6 each)* Directed readings and advanced research work under the supervision of a staff member arranged to suit the individual requirements of the students. *Pre: permission of chairperson.* Staff

694 Special Problems in Clinical Psychology *(I or II, 3–12)* Instruction and clinical practicum training in unique problem areas of clinical psychology. Development of specialized evaluation instruments and procedures. *(Lec. 3) Pre: permission of chairperson. May be repeated for a maximum of 12 credits.* Staff

695 Seminar: Teaching Psychology *(II, 3)* Primarily a seminar in the teaching of psychology at the undergraduate level. Includes a consideration of general issues in college teaching, preparation of a course proposal, and sample presentation. *(Lec. 3) Pre: permission of chairperson.* Quina, Stevenson, and Staff

696 Practicum: Teaching Psychology *(I or II, 3)* Practicum for students teaching a college-level psychology course. Supervision of course preparation, presentation, and evaluation. Individual supervision to be arranged. *(Lec. 3) Pre: 695 or permission of chairperson. S/U credit.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.* Staff

Resource Economics

M.S.

Graduate Faculty

Chairperson: Associate Professor Thomas F. Weaver, Ph.D., 1967, Cornell University
Professor John M. Gates, Ph.D., 1969, University of California
Professor Thomas A. Grigalunas, Ph.D., 1972, University of Maryland
Professor Jon G. Sutinen, Ph.D., 1973, University of Washington
Associate Professor James L. Anderson, Ph.D., 1983, University of California, Davis
Associate Professor James J. Opaluch, Ph.D., 1979, University of California, Berkeley
Associate Professor Timothy J. Tyrrell, Ph.D., 1978, Cornell University
Assistant Professor Stephen K. Swallow, Ph.D., 1988, Duke University
Assistant Professor Cathy Wessels, Ph.D., 1989, University of California, Davis
Assistant Professor Dennis G. Wichelns, Ph.D., 1986, University of California, Davis

Professor Emeritus Andreas Holmsen, Ph.D., 1960, Cornell University
Professor Emeritus Niels Rorholm, Ph.D., 1954, University of Minnesota
Professor Emeritus Irving A. Spaulding, Ph.D., 1944, Cornell University
Associate Professor Emeritus William H. Wallace, M.S., 1951, University of New Hampshire

Specializations

Commercial fisheries management, international fisheries development, fisheries business economics, coastal zone land use and management, quality of the marine environment, aquaculture economics, offshore oil and gas management, and natural resource pricing policies.

Master of Science

Admission requirements: GRE and a strong undergraduate record in economics or business is highly desirable.

Program requirements: thesis option—24 credits including REN 534, a written comprehensive examination, and thesis. Nonthesis option—34 credits including REN 534, a written comprehensive examination, and REN 591, with a substantial paper requiring significant independent research.

ECONOMICS–MARINE RESOURCES (Interdepartmental)
Ph.D.

This interdepartmental program offers study in the economics of marine resources. It is administered by the Department of Resource Economics with advice by graduate advisory faculty from several disciplines.

Graduate Faculty

Resource Economics: Associate Professor Weaver, *chairperson.* Professors Gates, Grigalunas, Sutinen; Associate Professors J. Anderson, Opaluch, and Tyrrell; Assistant Professors Swallow, Wessels, and Wichelns; Professors Emeritus Holmsen, Rorholm, and Spaulding; Associate Professor Emeritus Wallace.

Economics: Associate Professors Mead, Lardaro, Suzawa.

College of Business Administration: Professors Comerford, Della Bitta, Jarrett, Mojena, Rogers; Associate Professors Dash, N. Dholakia, Lord; Assistant Professor Lessne.

Specializations (Ph.D.)

Commercial fisheries management and marketing, international fisheries development, coastal zone land use and management, quality of the marine environment, aquacultural economics, offshore oil and gas management, and natural resource pricing policies.

Admission requirements: GRE, 6 credits in statistics, and the following courses or their equivalents—ECN 327, 328, and 375.

Program requirements: The Ph.D. qualifying examination is required of students admitted without the master's degree. ECN 527, 576, 628; REN 534, 602, 630, 634, 635, and 676. Additional courses may be elected from appropriate offerings in economics, resource economics, engineering, geography, oceanography, mathematics, political science, statistics, computer science, and management science. The dissertation will be written on a problem involving marine resources or an associated industry, such as minerals, petroleum, fisheries, water, transportation, recreation, or waste disposal.

REN Courses
Resource Economics

410 Economics of Natural Resource Use *(II, 3)*
432 Economics of Land and Water Resources *(II, 3)*
435 Aquacultural Economics *(I, 4)*
440 Benefit-Cost Analysis *(II, 3)*
456 Tourism Economics *(II, 3)*
460 Economics of Ocean Management *(II, 3)*
491, 492 Special Projects *(I and II, 1–3 each)*

514 Economics of Marine Resources *(I, 3)* Role of economics in development of marine resources. Particular attention to problems of multiple use of resources and to the conflicts between private and public goals. *(Lec. 3) Pre: enrollment in the M.M.A. program or permission of instructor.* Grigalunas

520 Production Economics *(II, 2)* Production in natural resource economics. The formulation and estimation of production functions. Technological change in economic growth and its measures. New directions in production theory and applications. *(Lec. 2) Pre: ECN 528 or permission of instructor.* Staff

522 Mathematical Programming for Natural Resource Management *(I, 2)* Application of mathematical (linear) programming to typical natural resource management issues. Emphasis is placed on problem formulation and solution using existing computer software programs. *(Lec. 2) Pre: 528 or permission of instructor.* Gates

524 Dynamic Economic Models *(I, 3)* Fundamentals of dynamic economic theory and nonlinear models. Dynamic and nonlinear optimization techniques applied to resource economics, decision analysis, and trade models. *(Lec. 3) Pre: 528 or permission of instructor.* Anderson

527 Macroeconomic Theory
See Economics 527.

528 Microeconomic Theory
See Economics 528.

532 Land Resource Economics
See Community Planning 537.

534 Economics of Natural Resources *(II, 3)* Microeconomic theory applied to problems of natural resource allocation. The rationale for government intervention in the market's provision of natural resources and alternative techniques for optimally allocated natural resources are investigated. *(Lec. 3) Pre: 528 or permission of instructor.* Wichelns

540 Applied Resource Economics *(II, 3)* Examines issues in agricultural and natural resource policy through applications of theoretical and empirical tools. Applications include pollution control, fisheries management, water, and agricultural policy. *(Lec. 3) Pre: 528 and ECN 376 or permission of instructor.* Opaluch

543 Economic Structure of the Fishing Industry *(I, 3)* Analysis of fishing industries from the standpoint of activity and efficiency. Problems related to common property resources, government policy, labor, and legal and institutional factors. *(Lec. 3) Pre: 514 or permission of instructor.* Staff

576 Econometrics
See Economics 576.

591, 592 Special Projects *(I and II, 1–3 each)* Advanced work under staff supervision arranged to suit the individual requirement of the student. *Pre: permission of chairperson.* Sutinen

595 (or ECN 595, MAF 595, PSC 595, SOC 595) Problems of Modernization in Developing Nations *(II, 3)* Selected regional problems in the environmental complex, agricultural systems, population dynamics, distribution systems, political integration, urbanization-industrialization, popular participation, integrated theories of modernization. *(Lec. 3) Pre: permission of instructors.* Krausse (Marine Affairs), Weaver (Resource Economics), Poggie (Sociology and Anthropology), Milburn (Political Science), and Suzawa (Economics)

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

602 Research Methodology *(I, 3)* Evaluation of alternative research methods and techniques. Development of specific research projects. *(Lec. 3) In alternate years. Next offered 1989–90.* Gates

610 Advanced Studies *(I and II, 1–3)* Advanced topics in resource economics. Mathematical models in resource management. *(Lec. 3) May be repeated with different topics.* Staff

630 Resource Analysis
See Economics 630.

634 Economics of Resource Development *(II, 3)* Concepts of economic efficiency applied to natural resources with emphasis on intertemporal allocation of nonrenewable and renewable resources. Application of welfare and institutional economics to resource management and development; analysis of optimum allocation among users. *(Lec. 3) Pre: 534.* Sutinen

635 Marine Resources Policy *(I, 3)* Analysis of public policy problems relating to the development and management of marine resources, including fisheries, minerals, petroleum, water, and recreation. *(Lec. 3) Pre: 534. In alternate years. Next offered 1990–91.* Grigalunas

676 Advanced Econometrics
See Economics 676.

677 Econometric Applications in Resource Economics *(II, 3)* Special topics in econometrics as applied to agriculture and natural resources. Topics include time series models. Bayesian analysis and dichotomous dependent variables. *Pre: 676.* Tyrrell

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Sociology

Admissions to the M.A. program in sociology have been suspended, and no applications are being accepted. The frequency with which the following 500-level courses are offered depends on the needs of students in other programs. For further information please contact the department directly.

SOC Courses
Sociology

401 History of Sociological Thought *(I or II, 3)*
408 Individual Life and Social Order *(I or II, 3)*
413 Sexual Inequality *(I or II, 3)*
420 Family Violence *(I or II, 3)*
424 Health Care Delivery Systems *(I or II, 3)*
426 Seminar in Law and Society *(II, 3)*
428 Institutional Racism *(I, 3)*
432 (or LRS 432) Industrial Sociology *(I or II, 3)*
437 (or HCF 437) Law and Families in the United States *(I, 3)*
438 Aging in Society *(II, 3)*
452 Class and Power *(II, 3)*
470, 471 Independent Study *(I and II, 3 each)*

501 Classical Sociological Theorists *(I, 3)* An in-depth study restricted to the works of Emile Durkheim, Karl Marx, and Max Weber with an emphasis on their contributions to contemporary sociological thought. *Pre: 492 or permission of instructor.* Staff

502 Contemporary Sociological Theory *(I or II, 3)* Critical examination of the theories and systems of contemporary sociologists. *(Lec. 3) Pre: 12 credits of sociology or permission of instructor.* Staff

505 Public Program Evaluation
See Political Science 505.

507 Methods of Sociological Research *(I, 3)* The logic of sociological inquiry with particular emphasis on the interrelationship between theory and fact through an examination of a variety of methodological procedures. *(Lec. 3) Pre: graduate standing or permission of instructor.* Staff

510 Seminar in Deviance *(I or II, 3)* Deviation from social expectations analyzed as a social phenomenon. Emphasis on deviation theories and research pertaining to individuals, subcultures, and social systems. Discussions, oral and written reports. *(Lec. 3) Pre: permission of chairperson.* Staff

518 Social Welfare: Planning and Policy *(II, 3)* Theories shaping attitudes toward institutional and residual welfare. Programs and agencies in the United States, their development, scope, and format. Poverty and myths; welfare reform proposals and the role of social scientists. *(Lec. 3) Pre: 492, 507, or permission of instructor. In alternate years.* Reilly

520 Seminar in Sociological Topics *(I or II, 3)* Advanced study of selected topics in sociology. *(Lec. 3) Pre: graduate or senior standing and permission of chairperson.* Staff

521 Behavior Systems in Crime *(I, 3)* Criminal behavior studied in categories useful for sociological analysis. Linkages of criminal behavior systems to the larger society; behavior systems in causal theorizing, justice, prevention, and corrections. *(Lec. 3) Pre: 330 or equivalent. In alternate years.* Carroll

522 Issues in Corrections *(II, 3)* Justifications for punishment and corrections; historical development; intensive survey of current research on deterrence, effectiveness of treatment, prison, violence, and other issues. *(Lec. 3) Pre: 330, EST 408, SOC 507, or permission of instructor. In alternate years.* Carroll

523 Institutional Racism *(I, 3)* Consideration of varying models of race and ethnic relations; examination of recent research on issues such as residential segregation, school desegregation, affirmative action, and racial disorders; comparisons of the United States with other societies. *(Lec. 3) Pre: EST 308, SOC 507, or permission of instructor. In alternate years.* Carroll and Reilly

524 Issues in Medical Care Delivery *(II, 3)* Special problems and selected readings in health care issues. *(Sem. 3) Pre: senior or graduate standing and permission of instructor. In alternate years. May not be taken for credit by students with credit in 424.* Rosengren

530 Mortality and Morbidity *(I, 3)* Study of demographic methods, trends, differentials, and policy regarding health and illness with emphasis on the United States. *(Lec. 3) Pre: 238 or permission of instructor. In alternate years.* Staff

552 Seminar in Teaching Undergraduate Sociology *(II, 3)* Seminar on issues and problems in teaching undergraduate sociology. Setting instructional goals, course planning, alternative course organizations, and relevant ancillary teaching materials. *(Lec. 3) Pre: permission of instructor. In alternate years.* Gelles

571, 572 Directed Study or Research *(I and II, 3 each)* Designed to cover areas of special research interests of graduate students not covered in other courses. *(Lec. 3) Pre: permission of chairperson.* Staff

595 Problems of Modernization in Developing Nations
See Resource Economics 595.

598 Field Placement and Seminar *(I and II, 6)* Supervised field experience with an emphasis on the application of sociological research to needs assessments, program planning, and evaluation; biweekly seminars; preparation of an original report based on the placement experience. *Pre: EST 308, SOC 507, and permission of chairperson.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

APG Courses
Anthropology

400 Bones, Mummies, and Disease *(II, 3)*
401 History of Anthropological Theory *(I or II, 3)*
402 Methods of Anthropological Inquiry *(I or II, 3)*
405 Psychological Anthropology *(I or II, 3)*
407 Economic Anthropology *(I or II, 3)*
412 Primate Behavior and Organization *(I or II, 3)*
413 (or MAF 413) Peoples of the Sea *(I, 3)*
470 Problems in Anthropology *(I and II, 3)*

Spanish

M.A.

Graduate Faculty

Chairperson: Professor Otto Dornberg, Ph.D., 1966, Ohio State University
Section Head: Professor Lewis J. Hutton, Ph.D., 1950, Princeton University
Director of Graduate Program: Professor Robert Manteiga, Ph.D., 1977, University of Virginia

Professor David M. Gitlitz, Ph.D., 1968, Harvard University
Professor Michael Navascués, Ph.D., 1971, Rutgers–The State University
Associate Professor Thomas D. Morín, Ph.D., 1975, Columbia University
Associate Professor Mario Trubiano, Ph.D., 1979, University of Massachusetts
Assistant Professor Clement White, Ph.D., 1988, Brown University

Specializations

The Master of Arts in Spanish is designed for those who wish to perfect their undergraduate achievement in the general area of Hispanic studies, including language mastery and understanding of literature in the total context of civilization and culture. The literary production of Spain, Spanish America, and the Spanish-speaking peoples of the United States will be studied. Any one of these areas could provide a field for specialization.

Master of Arts

Admission requirements: MAT or GRE, undergraduate major in Spanish or equivalent, including 12 credits in Spanish or Hispanic-American literature. Qualified students may be admitted with less than 12 credits but must make them up without graduate credit.

Program requirements: all work carried out in Spanish. Thesis option—30 credits including 6 thesis research credits. Nonthesis option—30 credits. All candidates must pass a written comprehensive examination and an oral comprehensive examination. Coursework may be completed on campus or through the URI summer study program in Salamanca, Spain, or a combination of both.

SPA Courses
Spanish

401 Oral and Dramatic Presentation of Hispanic Literature *(I, 3)*
410 Field Workshop *(SS, 3–6)*
421 Business Spanish *(I or II, 3)*
430 Castilian Prose of the Sixteenth and Seventeenth Centuries *(II, 3)*
431 Drama and Poetry of the Sixteenth and Seventeenth Centuries *(II, 3)*
451 The Spanish Novel of the Nineteenth Century *(I, 3)*
470 Topics in Hispanic Literature *(I and II, 3)*
481 Don Quixote *(I, 3)*
485 Modern Spanish Narrative *(II, 3)*
486 Modern Spanish Poetry and Drama *(II, 3)*
487 Modern Spanish-American Narrative *(I, 3)*
497, 498 Directed Study *(I and II, 3 each)*

503 Spanish Language Analysis and Methods of Research *(I, 3)* Advanced grammar and composition. Modes of literary interpretation and use of bibliography. Normally required of beginning graduate students. *(Sem. 3) Pre: graduate standing or permission of instructor.* Staff

510 Contemporary Spanish Workshop *(SS, 3–6)* New developments in all areas of Hispanic studies including pedagogical matters and classroom techniques. *(Lec. 3–6) Pre: graduate standing or permission of instructor.* Staff

561 Seminar in Medieval Poetry and Prose *(I, 3)* Examination and analysis of the epic, lyrical, and narrative medieval literature of Spain and its impact on subsequent literature. *(Sem. 3) Pre: graduate standing or permission of instructor.* Trubiano or Navascues

571 Modern Spanish-American Authors *(I, 3)* Analysis of human and artistic values in the drama, poetry, and narrative of selected modern Spanish-American authors. *(Lec. 3) Pre: graduate standing or permission of instructor. May be repeated with different topic and permission of instructor. In alternate years. Next offered fall 1989.* Morín or White

572 Evolution of Spanish-American Culture and Thought *(II, 3)* Development of Spanish-American thought and cultural trends, as portrayed in major works of artists and thinkers. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years. Next offered spring 1990.* Morín or White

580 Seminar in Nineteenth-Century Spanish Literature *(I or II, 3)* Selected authors and topics from the Spanish Romantic movement through realism and naturalism. *(Sem. 3) Pre: graduate standing or permission of instructor. May be repeated with different topic and permission of instructor.* Navascues or Trubiano

584 Interpretations of Modern Spain *(I, 3)* Development of Spanish thought particularly with respect to sociological and cultural problems from the eighteenth century to the contemporary period as seen through the writings of significant essayists. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years. Next offered spring 1990.* Manteiga or Navascués

585 Seminar in Twentieth-Century Spanish Literature *(I, 3)* Topics of aesthetic, cultural, and linguistic concern in twentieth-century peninsular literature. *(Sem.) Pre: graduate standing or permission of instructor. May be repeated with different topic and permission of instructor.* Manteiga

587 Seminar in Renaissance and Baroque Literature *(II, 3)* Aesthetic analysis of works representative of the period and their influence on subsequent literatures. *(Sem. 3) Pre: graduate standing or permission of instructor. May be repeated with different topic and permission of instructor.* Trubiano

590 The Hispanic Presence in the United States *(II, 3)* A study of the establishment of the Hispanic presence and its heritage in the art, folklore, and language of the United States, and an analysis of the literature of the Spanish-speaking peoples. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years. Next offered fall 1990.* Staff

597, 598 Directed Study *(I and II, 3 each)* Individual research and reports on problems of special interest. *Pre: graduate standing and approval of the director of graduate studies. May be repeated with different topic.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Speech–Language Pathology and Audiology

M.A., M.S.

Graduate Faculty

Chairperson: Associate Professor Jay Singer, Ph.D., 1976, Case Western Reserve University
Professor Walter J. Beaupre, Ph.D., 1962, Columbia University
Professor Barbara Culatta, Ph.D., 1975, University of Pittsburgh
Associate Professor Stephen D. Grubman-Black, Ph.D., 1972, State University of New York, Buffalo
Associate Professor Raymond M. Hurley, Ph.D., 1975, University of Michigan
Clinical Assistant Professor J. Barry Regan, D.Ed., 1967, Boston University

Specializations

Audiology and speech–language pathology.

Master of Arts and Master of Science

Admission requirements: MAT or GRE; 12 undergraduate credits in communicative disorders (always including CMD 372, 373, 374, and 375, or equivalents). Although test scores and cumulative average are not the sole criteria for admission to the graduate programs in speech–language pathology and audiology, those applicants with overall quality point averages of less than 3.00 on a 4.00 scale, or whose highest GRE verbal scores are not 500 or above, or whose MAT scores are not at the 50th percentile or above, may be advised to address background deficits to gain admission to the program. Completed applications are reviewed on a continuing basis.

Program requirements: for M.A. in speech–language pathology (46 credits), thesis, CMD 504, 26 credits in speech pathology, 7 credits in audiology. For M.A. in audiology (46 credits), thesis, CMD 504, 26

credits in audiology, 7 credits in speech pathology. For M.S. in speech–language pathology (46 credits), no thesis; written comprehensive examination; CMD 504, 32 credits in speech pathology and 7 credits in audiology. For M.S. in audiology (46 credits), no thesis; written comprehensive examination; CMD 504, 32 credits in audiology, and 7 credits in speech pathology. For either the M.A. or M.S. programs in speech–language pathology or audiology, students must complete 25 hours of directed observations and a minimum of 350 supervised clock hours of practicum in addition to the academic requirements. Because program requirements in both speech–language pathology and audiology include clinical responsibilities, the average length of time to complete any of the programs is two academic years.

Accelerated bachelor's/master's option for speech–language pathology or audiology students: University of Rhode Island senior undergraduate majors in communicative disorders who have met requirements for early acceptance by the Graduate School in either audiology or speech–language pathology may follow a special sequence of graduate-level coursework and clinical practicum during their senior year. If eligible, following the award of the Bachelor of Science degree in communicative disorders, students may complete a 30-semester-hour master's degree (rather than the usual 46-semester-hour master's degree) in one year of full-time graduate study. This option, which requires careful sequencing of senior and graduate coursework, is not available to students from other undergraduate institutions nor to students who elect part-time graduate study prior to completion of the fifth year.

Admission requirements: URI sixth-semester standing in communicative disorders with all major requirements completed and 25 elective credits remaining, a 3.00 cumulative GPA and 3.20 in the major through the fifth semester, MAT or GRE scores in at least the 50th percentile, and three letters of recommendation, two of which must be from URI communicative disorders faculty.

Program requirements: for students who have taken the specified 25 credits (16 of which must be at the 500 level) of communicative disorders coursework in the senior year to complete the bachelor's degree in communicative disorders, 30 credits of coursework in the fifth year (postbaccalaureate) at the 500 level. Specific course requirements are as stated in the regular two-year master's program.

CMD Courses
Communicative Disorders

475 Gestural Communication *(I, 2)*

491, 492 Special Problems *(I and II, 1–3 each)*

504 Speech and Hearing Research *(II, 3)* Types of research in speech pathology, audiology, and communication science; critiques of representative models with special emphasis on experimental research; individual pilot projects or master's thesis. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Staff

506 Speech and Hearing Science *(I, 3)* Critical analysis of experimental data concerning the parameters of speech and the fundamental concepts in normal audition. Course will include introduction to instrumentation. *(Lec. 1, Lab. 2) Pre: 504 or permission of instructor.* Hurley

551 Measurement of Hearing *(I, 3)* Diagnostic protocols and practicum for routine audiological assessment; etiology and symptomatology of hearing disorders; overview of aural rehabilitation including hearing aids. *(Lec. 2, Lab. 1) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Singer

552 Advanced Measurement of Hearing *(II, 3)* Advanced audiometrics; speech audiometry; immittance measures, cochlear measures; retrocochlear measures; pseudohypacusis measures, and central auditory measures. *(Lec. 2, Lab. 2) Pre: 551 or permission of instructor.* Hurley

553 Pediatric Audiology *(I, 3)* Theoretical and methodological approaches to the identification and management of children with auditory disorders. Topics discussed include auditory development, audiometric evaluation, and hearing aids. *(Lec. 3) Pre: 551 or permission of instructor.* Hurley

554 Rehabilitative Audiology *(I, 3)* Theoretical and methodological approaches to aural rehabilitation of the hearing-impaired adult. Topics discussed include use of amplification, speech reading, auditory training, and case management. *(Lec. 3) Pre: 551 or permission of instructor.* Hurley

555 Amplification for the Hearing Impaired *(II, 3)* Electroacoustics and psychoacoustics of wearable hearing aids; selection and fitting procedures, counseling; classroom amplification systems. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor. In alternate years.* Singer

556 Electrophysiological Measures in Audiology *(II, 3)* Basic electrophysiologic procedures, instrumentation, electrocochleography, auditory brain stem responses, and middle, late, and long-latency auditory evoked potentials. *(Lec. 2, Lab. 2) Pre: 551, 552, or permission of instructor.* Hurley

560 Disorders of Phonation *(II, 3)* Etiology and symptomatology of vocal pathology; intervention strategies for organic and functional voice disorders; emphasis on rehabilitation team approach to voice-resonance problems associated with cleft palate. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Beaupre

561 Articulation Disorders *(I, 3)* Assessment, design, and implementation of therapeutic management programs for various speech production disorders at the articulatory and phonological levels. *(Lec. 3) Pre: 372, 373, 374, 375, or equivalent, or permission of instructor.* Grubman-Black

564 Language Disorders in School-Aged Children *(II, 3)* Study of communication deficits in learning-disabled school-aged children; differential diagnoses; assessment of cognitive functioning; language processing and discourse; therapeutic strategies for training abstract and functional language. *(Sem. 3) Pre: graduate standing or permission of instructor.* Culatta

567 Clinical Practicum in Speech Pathology *(I and II, 1–3)* Supervised diagnostic and therapeutic procedures with persons experiencing communicative disorders. Differential diagnosis, parent counseling, and cooperation with allied personnel. Practicum held on campus and within institutional and school settings. *(Lab. 3–9) Pre: graduate standing.* Staff

568 Clinical Practicum in Audiology *(I and II, 1–3)* Supervised clinical practicum concerned with audiological assessment of hearing disorders and auditory rehabilitation with the hearing impaired. Practicum held on campus and within institutional and school setting. *(Lab. 3–9) Pre: 551 and graduate standing.* Staff

569 Diagnostic Procedures *(I, 3)* Major procedures for assessment and evaluation in speech–language pathology. Implications of diagnostic data for referrals, prognosis, therapeutic programs, and consultations. *(Lec. 3) Pre: 372, 373, 374, 375, or equivalent, or permission of instructor.* Grubman-Black

570 Clinical Practicum in Communicative Disorders *(I and II, 1–5)* Supervised assessment and rehabilitation procedures with persons experiencing communicative disorders in speech–language pathology and/or audiology. Practicum sites scheduled on campus and within hospital, school, institutional, and private settings. *(Lab. 2–10 hours) Pre: graduate standing, 25 observation hours, and appropriate coursework.* Staff

572 Medical Audiology *(I, 3)* Diagnostic implications of audiometry for various organic disorders; supportive audiological information relevant to medical and surgical interventions; differential data associated with otosclerosis, Meniere's disease, VIIIth cranial nerve tumors, and malingering. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Hurley

573 Contemporary Problems in Audiology *(II, 3)* Critical review of current research and controversial issues within the profession; student selects one topic for independent study. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Staff

574 Environmental Audiology *(II, 3)* Hearing problems in industry, in the military, and other high-noise-level environments; medico-legal aspects of hearing loss; hearing conservation programs in public schools. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Singer

577 Speech and Language for Hearing Impaired *(II, 3)* Assessment, development and/or maintenance of voice, speech, and language skills associated with congenital or adventitious deafness; seminar approach to strategies in current practice with children and adults. *(Sem. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Beaupre

580 Augmentative Communication *(II, 3)* Assessment, selection, and implementation of augmentative communication devices and systems for severely communicatively impaired persons emphasizing the transdisciplinary approach, fabrication, and experience with current electronic equipment. *(Lec. 3) Pre: coursework in aphasia, cerebral palsy, or head trauma, and permission of instructor.* Lytton or Carlson

581 Cerebral Palsy *(I, 3)* Identification of type of cerebral palsy by location of lesion, motor symptomatology, and additional handicaps; role of the speech clinician on the team; types of speech therapy with emphasis on the Bobath approach; current research and controversial issues. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Staff

584 Language Disorders in Developmentally Young Children *(I, 3)* Study of communication deficits in developmentally young and multihandicapped children; types of language problems; differential diagnoses; assessment of conceptual requisites and concrete language skills; interactive therapeutic strategies. *Pre: graduate standing or permission of instructor.* Culatta

585 Aphasia and Allied Language Disorders *(II, 3)* Types of adult aphasia; central and peripheral dysarthrias; role of speech clinician on the rehabilitation team; other degenerative disorders such as Parkinsonism and dystonia; current research and controversial issues. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Grubman-Black

586 Alaryngeal Speech *(I, 3)* Voice and speech rehabilitation for individuals without a functional larynx; social, emotional, and medical considerations; clinical procedures for esophageal, pharyngeal, and buccal speech; implications for use of artificial larynx; current research. *(Lec. 3) Pre: 372, 373, 374, 375, graduate standing, or permission of instructor.* Beaupre

591 Contemporary Issues in Speech and Language Pathology *(II, 3)* Critical review of selected current research and controversial issues in the profession. Topics will vary each offering. *(Sem. 3) Pre: minimum of 15 graduate credits in speech–language pathology, including 504, or permission of instructor. May be repeated for a maximum of 6 credits.* Beaupre, Grubman-Black, and Culatta

592 Stuttering and Cluttering *(I, 3)* Study of nature and causes of stuttering; analyses of current theories and research concerning stuttering and cluttering; development of a rationale for diagnosis, case selection, and intervention. *(Lec. 3) Pre: graduate standing and/or permission of instructor.* Grubman-Black

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Statistics
M.S.

Graduate Faculty

Chairperson: Associate Professor Edmund A. Lamagna, Ph.D., 1975, Brown University
Professor Edward J. Carney, Ph.D., 1967, Iowa State University
Professor R. Choudary Hanumara, Ph.D., 1968, Florida State University
Professor James F. Heltshe, Ph.D., 1973, Kansas State University
Associate Professor William D. Lawing, Ph.D., 1965, Iowa State University
Assistant Professor Roger W. Peck, Ph.D., 1983, University of Texas, Dallas
Professor Emeritus Peter F. Merenda, Ph.D., 1957, University of Wisconsin

Specializations

Experimental design, sampling, ecological statistics and biostatistics, statistical computation, simulation, multivariate analysis, nonparametric methods, classification and discrimination, analysis of variance, bootstrap and jackknife estimation, sequential methods.

Master of Science

Admission requirements: bachelor's degree including the equivalent of MTH 141, 142 Introductory and Intermediate Calculus with Analytic Geometry; MTH 243 Calculus for Functions of Several Variables; MTH 215 Introduction to Linear Algebra; CSC 201 Introduction to Computing; EST 409 Statistical Methods in Research I. GRE, including advanced test in mathematics or undergraduate field, are required for admission.

Thesis option program requirements: a minimum of 24 credits (exclusive of thesis) including MTH 451, EST 412, either EST 501 or 502, and at least 9 additional credits selected from EST 500, 501, 502, 520, 541, 542, 550, 592, 611.

Nonthesis option program requirements: 33 credits distributed as follows:

1) MTH 451, EST 412, and either EST 501 or 502.

2) At least 9 credits selected from EST 500, 501, 502, 520, 541, 550, 592, 611.

3) At least 6 of the remaining credits must be at the 500 level or above (exclusive of EST 591).

4) The above coursework must include at least one course that requires a substantial paper involving significant independent study.

5) Written comprehensive examination.

Doctor of Philosophy

Please see the listing under Applied Mathematical Sciences on page 24.

General Information

Programs of study can be designed for individuals who are employed on a full-time basis.

EST Courses
Experimental Statistics

407 Introductory Biostatistics *(I or II, 3)*
409 Statistical Methods in Research I *(I or II, 3 each)*
412 Statistical Methods in Research II *(I or II, 3)*
413 Data Analysis *(I or II, 3)*
491 Directed Study in Experimental Statistics *(I and II, 1–3)*
492 Special Topics in Experimental Statistics *(I or II, 3)*

500 Nonparametric Statistical Methods *(I or II, 3)* Rank and sign tests, permutation tests and randomization, run test, tests of goodness of fit, order statistics, estimation, and comparison with parametric procedures. Examples illustrating the applications of nonparametric techniques. *(Lec. 3) Pre: 308 or 409.* Staff

501 Analysis of Variance and Variance Components *(I or II, 3)* Analysis of variance and covariance, experimental design models, factorial experiments, random and mixed models, estimation of variance components, unbalanced data. *(Lec. 3) Pre: 412.* Staff

502 Applied Regression Analysis *(I or II, 3)* Topics in regression analysis including subset selection, biased estimation, ridge regression, and nonlinear estimation. *(Lec. 3) Pre: 412.* Staff

517 Small N Designs
See Psychology 517.

520 Fundamentals of Sampling and Applications *(I or II, 3)* Simple random sampling; properties of estimates, confidence limits. Sample size. Stratified random sampling; optimum allocation, effects of errors, and quota sampling. Regression and ratio estimates; systematic and multistage sampling. *(Lec. 3) Pre: 308 or 409.* Staff

532 (or ASP 532 or PSY 532) Experimental Design *(I or II, 3)* Application of statistical methods to biological and psychological research and experimentation. Experimental situations for which various ANOVA and ANCOVA designs are most suitable. *(Lec. 3) Pre: 308 or 409 or equivalent.* Staff

541 Multivariate Statistical Methods *(I or II, 3)* Review of matrix analysis. Multivariate normal distribution. Tests of hypotheses on means, Hotelling's T^2, discriminate functions. Multivariate regression analysis. Canonical correlations. Principal components. Factor analysis. *(Lec. 3) Pre: 412.* Staff

542 Discrete Multivariate Methods *(I or II, 3)* Analysis of multidimensional categorical data by use of log-linear and logit models. Discussion of methods to estimate and select models followed by examples from several areas. *(Lec. 3) Pre: 412.* Staff

550 Ecological Statistics *(I or II, 3)* Application of statistical methodology to the following topics: population growth, interactions of populations, sampling and modeling of ecological populations, spatial patterns, species abundance relations, and ecological diversity and measurement. *(Lec. 3) Pre: 409 or permission of instructor.* Staff

576 Econometrics
See Resource Economics 576.

584 Pattern Recognition
See Electrical Engineering 584.

591 Directed Study in Experimental Statistics *(I and II, 1–3)* Advanced work in experimental statistics conducted as supervised individual projects. *Pre: permission of chairperson. S/U credit.* Staff

592 Special Topics in Experimental Statistics *(I or II, 3)* Advanced topics of current interest in experimental statistics. *(Lec. 3) Pre: permission of chairperson.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

610 Parsimony Methods
See Psychology 610.

611 Linear Statistical Models *(I or II, 3)* Review of mathematical and statistical concepts. Multivariate normal distribution. Distribution of quadratic forms. Power of the F-test. Basic linear models: general linear hypothesis, regression models, experimental design models, variance component models, mixed models. *(Lec. 3) Pre: 501 or 502.* Staff

612 Structural Modeling
See Psychology 612.

635 Response Surfaces and Evolutionary Operations
See Industrial and Manufacturing Engineering 635.

Teacher Certification

Students who did not obtain Rhode Island Teacher Certification as part of their undergraduate studies may do so in most cases without becoming graduate degree candidates by taking a prescribed set of courses in the appropriate fields. Such applicants should check "TCP" on the application forms and submit two official transcripts of all prior academic work, showing receipt of the bachelor's degree, plus a statement of objectives and two letters of recommendation. Applications are reviewed in May, August, and December. Program space is limited, and admission is competitive. Standardized test scores are not required unless the student is also applying for a graduate degree. Further information may be obtained from the Graduate School Admissions Office or from one of the following program representatives.

Early Childhood Education: Assistant Professor Susan Trostle, Department of Education

Elementary Education: Assistant Professor Virginia Bartel, Department of Education

Secondary Education:
English: Associate Professor Richard Nelson, Department of Education
Mathematics: Professor William Croasdale, Department of Education
Science: Associate Professor Theodore Kellogg, Department of Education
Social Studies: Professor Robert MacMillan, Department of Education
Languages: Professor Remo Trivelli, Department of Languages

Communicative Disorders: Associate Professor Jay Singer, Department of Communicative Disorders

Home Economics Education: Associate Professor Theodore Kellogg, Department of Education

Music Education: Professor Kenneth Keeling, Department of Music

Physical Education: Professor Jeannette Crooker, Department of Physical Education, Health, and Recreation

Resource Development: Assistant Professor Anthony Mallilo, Department of Resource Development Education

School Library Media: Assistant Professor Patricia Jensen, Graduate School of Library and Information Studies

Business Education: (special arrangements necessary) Professor Clay Sink, Department of Management

Textiles, Clothing, and Related Art

M.S.

Graduate Faculty

Chairperson: Associate Professor Linda M. Welters, Ph.D., 1981, University of Minnesota
Associate Professor Misako Higa, Ph.D., 1973, University of Minnesota
Associate Professor Patricia A. Helms, Ph.D., 1971, Florida State University
Assistant Professor Catherine A. Cerny, Ph.D., 1987, University of Minnesota
Assistant Professor Karen E. Kyllo, Ph.D., 1984, Purdue University
Adjunct Professor Laurence F. Gross, Ph.D., 1976, Brown University
Adjunct Professor Paul Hudon, Ph.D., 1971, Georgetown University

The department offers a wide variety of individualized programs in close association with other departments such as history, art, chemistry, education, marketing, human development, counseling, and family studies, and various social science fields.

Specializations

Apparel science, historic textiles and costume, marketing textiles, gerontology, and other special populations.

Master of Science

Admission requirements: GRE and a bachelor's degree with adequate preparation for the proposed area of study.

Program requirements: thesis or nonthesis option, 30 credits. All specializations require TMD 524, 533, and 3 credits of research methods. The research methods course should be selected in consultation with the major professor and be supportive of the student's research interest.

For historic textile and costume specialization: thesis option—minimum of 30 credits including TMD 510, 520, 524, 533, 599, completion of a supervised internship (TMD 530, 2–4 credits) and 8–10 elective credits, half of which must be from textiles, fashion merchandising, and design courses numbered 500 or above; nonthesis option—30 credits including TMD 510, 520, 524, 533, 550, 560, completion of a supervised internship (TMD 530, 2–4 credits), and 8–10 elective credits, half of which must be from textiles, fashion merchandising, and design courses numbered 500 or above. A minimum of 9 credits is required to achieve a competency level in an allied field such as art history, history, sociology, or anthropology; this may result in a program of more than 30 credits. The committee may elect to waive this requirement if the candidate has had adequate preparation in the allied field as an undergraduate. Candidates lacking undergraduate courses in

textile science and historic costume may be required to make up deficiencies without graduate credit.

For other specializations: thesis option—TMD 524, 533, EDC 529 or 3 credits in research methods selected in consultation with major professor; other courses chosen in accordance with student's background, interest, and needs; written comprehensive examination; oral defense of thesis; nonthesis option—TMD 524, 533, 550, 560, and 3 credits of research methods selected in consultation with major professor; other courses chosen in accordance with student's background, interest, and needs; written comprehensive examination. A maximum of 12 credits may be elected in allied fields for either thesis or nonthesis option.

TMD Courses
Textiles, Fashion Merchandising, and Design

403 Textile Performance *(II, 3)*
405 Advanced Clothing *(II, 2)*
406 (546) Historic Furniture *(I, 3)*
416 Interior Design II *(I, 3)*
432 Fashion Merchandising Operations Control *(II, 3)*
433 Textile Markets *(II, 3)*
440 Historic Textiles *(I, 3)*
496 Interior Furnishings and Design Internship *(II, 3)*

500 Ethnic Costume and Textiles *(II, 3)* Survey of regional styles of costume and textiles from all areas of the world, excluding fashionable dress. Influence of social, economic, technological, and aesthetic factors. *(Lec. 3) Pre: 224 or equivalent, 340, 440, or permission of instructor. In alternate years. Next offered spring 1990.* Welters

502 Seminar in Textiles and Clothing *(II, 3)* Original investigations in areas of clothing and textile production, marketing, and conservation. *(Lec. 3) Pre: at least one upper-level undergraduate or graduate course in the area of investigation. May be repeated for a maximum of 6 credits with different topic.* Staff

503 Advanced Textiles *(I, 3)* Analysis of the physical and chemical structure of textile fibers, chemical and polymeric finishes including dyes, and the research methods used to determine consumer market demands. *(Lec. 2, Lab. 2) Pre: 403 and EST 408 or equivalent. In alternate years.* Kyllo

510 Historical Research Methods: Textiles and Furnishings *(I, 3)* Application of research methodology to the study of historic textiles, costume, furniture, and furnishings. Approaches primary sources, data collection, and research design. *(Lec. 3) Pre: 340, 440, or 406, or permission of instructor.* Welters or Ordoñez

513 Detergency *(II, 3)* Study of chemical and mechanical interactions of textile fibers, fabrics, laundering products, equipment, and soils. Laboratory experience in evaluation of laundry products and fabric durability during laundering. *(Lec. 2, Lab 2) Pre: graduate standing, 303 or equivalent, and permission of instructor. In alternate years. Next offered spring 1991.* Kyllo

520 Textile Conservation *(II, 3)* Introduction to storage and conservation of textiles and costumes in the museum setting. Laboratory experience in conservation practices. *(Lec. 2, Lab. 2) Pre: 6 credits in textile science and permission of the instructor. In alternate years. Next offered fall 1990.* Ordoñez

524 Social and Psychological Aspects of Textiles and Clothing *(II, 3)* Seminar in social and psychological aspects of textiles and clothing. Theories and assumptions concerning relevance of clothing to individuals and groups. *(Lec. 3) Pre: 224 or permission of instructor.* Cerny

530 Historic Textile Internship *(I and II, 2–4)* Supervised internship designed to introduce the student to management of textile and costume collections in a museum or historical society setting. Individually designed to suit student needs—conservation, education, and research. *Pre: 510, 520, graduate standing in textiles, clothing, and related art, or permission of chairperson.* Welters or Ordoñez

533 Textile and Clothing Economics *(I, 3)* Economic development of production and distribution of textiles and clothing. *(Lec. 3)* Helms

540 Special Problems in Textiles and Clothing *(I and II, 3)* Supervised independent study in specific areas of textiles and clothing. *Pre: permission of chairperson.* Staff

550 Prepracticum *(I and II, 3)* Supervised study in intended practicum subject area resulting in written review of literature and proposal for practicum. *Pre: permission of departmental committee.* Staff

560 Practicum *(I and II, 3)* Supervised practicum as proposed in 550. Results reported in both oral and written form. *Pre: 550.* Staff

596 Interior Furnishing and Design Seminar *(II, 3)* Historic and modern furnishings; interior space, structures, and design as they relate to furniture, equipment, fixtures, accessories, interior materials, and fabrics. *Pre: 406 or equivalent and permission of instructor. In alternate years.* Higa

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Zoology
M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor J. Stanley Cobb, Ph.D., 1969, The University of Rhode Island
Professor Robert F. Costantino, Ph.D., 1967, Purdue University
Professor Clarence C. Goertemiller, Jr., Ph.D., 1964, Brown University
Professor Carl S. Hammen, Ph.D., 1958, Duke University
Professor Frank H. Heppner, Ph.D., 1967, University of California, Davis
Professor Robert B. Hill, Ph.D., 1957, Harvard University
Professor Kerwin E. Hyland, Jr., Ph.D., 1953, Duke University
Professor C. Robert Shoop, Ph.D., 1963, Tulane University
Professor Howard E. Winn, Ph.D., 1955, University of Michigan
Associate Professor Harold D. Bibb, Ph.D., 1969, University of Iowa
Associate Professor Robert C. Bullock, Ph.D., 1972, Harvard University
Associate Professor Marian R. Goldsmith, Ph.D., 1970, University of Pennsylvania
Associate Professor Gabriele Kass-Simon, D.Phil., 1967, University of Zurich
Associate Professor William H. Krueger, Ph.D., 1967, Boston University
Associate Professor John P. Mottinger, Ph.D., 1968, Indiana University
Associate Professor Jennifer L. Specker, Ph.D., 1980, Oregon State University
Assistant Research Professor David A. Bengston, Ph.D., 1972, The University of Rhode Island
Assistant Professor Saran Twombly, Ph.D., 1983, Yale University
Adjunct Professor Donald C. Miller, Ph.D., 1965, Duke University
Adjunct Professor Ruth D. Turner, Ph.D., 1954, Radcliffe College, Harvard University
Adjunct Assistant Professor Thomas N. Mather, Ph.D., 1983, University of Wisconsin
Professor Emeritus Saul B. Saila, Ph.D., 1952, Cornell University
Professor Emeritus Charles E. Wilde, Jr., Ph.D., 1949, Princeton University

Specializations

Acarology, animal behavior, cytology, developmental biology, ecology, electron microscopy, embryology, endocrinology, entomology, fisheries biology, genetics (developmental, ecological, population), herpetology, histology, ichthyology, invertebrate zoology, limnology, mammalogy, neurobiology, ornithology, parasitology, physiological ecology, physiology (cellular, comparative, mammalian), radioecology, reproductive biology, taxonomy, tissue culture, and molecular biology.

Master of Science

Admission requirements: GRE with advanced test (biology) and bachelor's degree with major in zoology, biology, or allied field. Applicants are normally admitted for September only. Applications should be completed by April 15.

Program requirements: thesis.

Doctor of Philosophy (Biological Sciences)

Admission requirements: master's degree is not required. GRE with advanced test (biology) and bachelor's degree with major in zoology, biology, or allied field. Applicants are expected, but not required, to have a reading knowledge of two languages in addition to their native language. Applicants are normally admitted for September only. Applications should be completed by April 15.

Program requirements: dissertation, qualifying examination required for all candidates except holders of M.S. degree. Although there is no departmental language requirement, the candidate's committee may require demonstration of proficiency in one or two languages other than the candidate's native language.

ZOO Courses

Zoology

416 Embryology of Marine Organisms *(II, 3)*
437 (or BOT 437) Fundamentals of Molecular Biology *(I, 3)*
442 Mammalian Physiology *(II, 3)*
443 Environmental Physiology of Animals *(I, 3)*
445 Endocrinology I *(I, 3)*
455 (or BOT 455) Marine Ecology *(I, 3)*
457 (or BOT 457) Marine Ecology Laboratory *(I, 1)*
460 Advanced Population Biology *(II, 3)*
465 Limnology *(I, 4)*
466 Vertebrate Biology *(II, 3)*
467 Animal Behavior *(II, 3)*

501 Systematic Zoology *(I, 3)* Species concepts and theories of biological classification. Taxonomic decisions and publication, numerical taxonomy, and review of the rules of zoological nomenclature. *(Lec. 3) Pre: ZOO 262 and BOT 352, 254 or 466 recommended. In alternate years.* Bullock

505 Biological Photography *(I, 2)* Application of scientific photography to biological subjects, living and prepared. Photomacrography and photomicrography. Principles of photography as applied to the specialized needs of biological research and publication. *(Lab. 6) Pre: permission of instructor.* Heppner

508 Seminar in Zoological Literature *(II, 1)* Survey of zoological literature including traditional methods of bibliographic control, contemporary information retrieval services, and the development of a personalized information system. *(Lec. 1) Pre: graduate standing in zoology.* Kelland

512 Fine Structure *(II, 3)* Interpretation and integration of experimental evidence on the functional morphology of metazoan cells and their subcellular components and of the interstitium. Wherever feasible, study is carried down to the level of macromolecular or molecular structure. It includes a consideration of experimental methods. *(Lec. 2, Lab. 3) Pre: 327 or its equivalent.* Staff

518 Mechanisms of Development *(I, 2)* Current concepts of mechanisms responsible for developmental changes. Morphological, chemical, and genetic aspects of development are treated in discussions of morphogenetic movements, cell differentiation, and organogenesis. *(Lec. 2) Pre: 221 or 316 or 320 or equivalent, BOT 352 recommended.* Bibb, Goertemiller, and Hufnagel

521 Recent Advances in Cell Biology See Microbiology 521.

531 Advanced Parasitology Seminar *(II, 2)* Advanced topics in the host-parasite relationships of protozoan and metazoan parasites. Reading knowledge of one foreign language assumed. Topics vary from year to year. *(Lec. 2) Pre: 331 or equivalent.* Hyland

541 Comparative Physiology *(I, 3)* Comparison of physiological mechanisms by which animals maintain life with emphasis on marine invertebrates. Responses to external environment mediated by receptors, nervous systems, effectors. Living control systems for muscular activity and circulation. *(Lec. 2, Lab. 3) Pre: 101 and 345. In alternate years. Next offered 1990–91.* Hammen and Hill

543 Biology of Reproduction in Animals *(I, 3)* Aspects of reproduction in animals of different phyla. Hormonal interrelationships, environmental control, and adaptive mechanisms. *(Lec. 2, Lab. 3) Pre: 345 and 545. In alternate years. Next offered 1990–91.* Staff

545 Endocrinology II *(I, 3)* Molecular basis of hormone action and evolution of regulatory systems. *(Lec. 3) Pre: BCP 311, ZOO 442, graduate standing, and permission of instructor. In alternate years. Next offered 1989–90.* Specker

548 Neurophysiology *(II, 4)* Fundamental processes occurring in the nervous systems of invertebrates and vertebrates. Structure and functions of nervous elements with emphasis on integration and coordination. *(Lec. 3, Lab. 3) Pre: 345, MTH 141 or equivalent recommended, and permission of instructor. In alternate years. Next offered 1989–90.* Kass-Simon

549, 550, 551 Advanced Topics in Neurobiology *(II, 3 each)* Published papers in selected aspects of neurobiology will be discussed. Representative topics include role of Ca++, c-AMP in the nervous system, gating currents learning at the cellular level, cellular rhythmicity. *(Lec. 3) In alternate years. Next offered 1990–91.* Kass-Simon

561 Behavioral Ecology *(I, 3)* The interaction of animal behavior, ecology, and evolution. Topics include predator-prey relationships, resource partitioning, competition, territoriality, and reproductive behavior. Term project required. *(Lec. 1, Rec. 2) Pre: a course in animal behavior and a course in ecology. In alternate years. Next offered 1989–90.* Cobb

562 Seminar in Behavioral Ecology *(I, 1)* Special topics in the relationships between animal behavior and ecology, such as social organization of animals, evolution of behavior, competition, and habitat selection. Discussion and presentation of individual reports. *(Lec. 1)* Cobb

563 Ichthyology *(I, 3)* Fishes of the world. Their structure, evolution, classification, ecology, and physiology. Emphasis on local marine and freshwater fauna. Several field trips. *(Lec. 2, Lab. 3) Pre: 221 or 316 and 466.* Krueger

564 Oceanic Ichthyology *(II, 3)* Fishes of the great ocean basins. Their systematics, adaptations, vertical distribution, and zoogeography. Emphasis on mesopelagic and bathypelagic forms in the North Atlantic. *(Lec. 2, Lab. 3) Pre: 563 or permission of instructor. In alternate years. Next offered 1989–90.* Krueger

566 Herpetology *(II, 3)* Biology of recent orders of amphibians and reptiles; emphasis on adaptations and evolution, world faunal relationships past and present, current systematic problems. Selected herpetological material in laboratory, field trips. *(Lec. 2, Lab. 3) Pre: 221 or 316 or permission of instructor.* Shoop

567 Natural Selection *(II, 2)* Ideas and controversies concerning the action of natural selection. Maintenance of genetic variability, neutral mutation, levels of selection, recombination and sexual reproduction, and rates of evolution. *(Lec. 2) Pre: 262 and BOT 352 or ZOO 260, or permission of instructor.* Staff

568 Ornithology *(II, 2)* Biology of birds with emphasis on the role of birds in biological research. Areas covered include systematics, evolution, physiology, ecology, and behavior. Discussion of current topics in ornithology. *(Lec. 2) Pre: 466 or permission of instructor.* Heppner

570 Field Biology of Fishes *(II, 3)* Selected field problems in fish biology, including distribution and diversity, habitat segregation, reproduction, and natural movements. Emphasis on freshwater and diadromous populations. *(Lec. 1, Lab. 5) Pre: 563 or permission of instructor. Limited to 10 students with preference given to graduate students and senior zoology majors. In alternate years. Next offered 1990–91.* Krueger

573 Developmental Genetics *(I, 3)* Genetic control of gametogenesis and fertilization. Survey of modern approaches to the problem of gene regulation during embryogenesis with animal systems. *(Lec. 3) Pre: BOT 352 (or AVS 352) or equivalent and permission of instructor.* Goldsmith

576 Ecological Genetics *(II, 4)* Hereditary structure of populations, population strategy in heterogeneous environment, species area-diversity patterns, strategy of colonization, stepping stones and biotic exchange. *(Lec. 3, Lab. 3) Pre: one semester of genetics.* Costantino

579 (or BOT 579) Advanced Genetics Seminar *(I and II, 1)* Current topics in genetics, including cytological, ecological, molecular, physiological, population, quantitative, and radiation genetics. *(Lec. 1) Pre: BOT 352 and permission of instructor.* Costantino and Mottinger

581 General Acarology *(I, 3)* Detailed study of mites and ticks, their structure, life histories, and classification. Free-living forms as well as plant and animal feeders. *(Lab. 6) Pre: 331 or 481 or 586 and permission of instructor. In alternate years. Next offered 1989–90.* Hyland

586 Medical and Veterinary Entomology *(II, 3)* Life histories, classifications, habits, and control of insects and other arthropods which affect the health of man and animals. Duties of the entomologist on a public health team, including field practice in methods of insect surveys, control measures, and subsequent surveys to determine success of control measures. *(Lec. 1, Lab. 4) Pre: 331 or 381 or equivalent. In alternate years. Next offered 1990–91.* Hyland

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

641, 642, 643, 644, 645 Seminar in Physiology *(I and II, 1–3 each)* Reports and discussions on topics of current research in physiology. Subject matter adapted to meet interests of staff and students. *(Lec. 1–3) Pre: 345.* Staff

646 Advanced Mammalian Physiology *(II, 2)* Reports and discussions on topics of current research in mammalian physiology coordinated with 442. *(Lec. 2) Pre: concurrent enrollment in 442 or permission of instructor.* Hill

664 Seminar in Ichthyology *(II, 2)* Reading, library research, reports, and class discussion on problems of current research interest in the biology of fishes. *(Lec. 2) Pre: 563 or permission of instructor. In alternate years. Next offered 1989–90.* Krueger

675 Advanced Ecology Seminars *(I and II, 2 each)* Specialized and advanced areas of ecological research and theory, including zoogeography, Pleistocene ecology, population dynamics, energy flow in ecosystems, and radiation ecology. *Pre: permission of instructor.* Shoop and Staff

679 Animal Communication
See Oceanography 679.

691, 692 Assigned Work *(I and II, 1–3 each)* Subject matter adapted to meet needs of the student. May be arranged with any staff member. *(Lec. 3 or Lab. 6) Pre: permission of chairperson.* Staff

693, 694 Zoological Problems *(I and II, 1–3 each)* Special work to meet needs of individual students who are prepared to undertake special problems. *(Lec. 1–3 or Lab. 2–6) Pre: permission of chairperson. S/U credit for 694.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *S/U credit.*

Other Courses

The following are courses grouped by additional subject areas, or courses which may be taken for graduate credit, but are not part of a graduate program. Descriptions of the 400-level courses are found in the *Undergraduate Bulletin.* Where descriptions for 500-level courses are not provided, they will be found earlier in this bulletin.

AAF Courses
African and Afro-American Studies

410 (or PSC 410) Issues in African Development *(I and II, 3)*
474 (or ENG 474) Topics in Pan-African Literature *(II, 3)*

ART Courses
Art

405, 406 Studio Seminar *(I and II, 3 each)*

501, 502 Graduate Studio Seminar I, II *(I and II, 3 each)* Intensive independent studio work under guidance of instructors. Periodic critiques and discussions related to work of all participants in the course. *(Studio 6) Pre: 48 credits in studio for 501; 501 for 502.* Staff

ARH Courses
Art History

461 Topics in Methods, Theory, and Criticism *(I or II, 3)*
462 Contemporary Art Seminar: Art since 1945 *(II, 3)*
469, 470 Art History: Senior Projects *(I and II, 3–6 each)*
480 Advanced Topics in European and American Art *(I or II, 3)*

DHY Courses
Dental Hygiene

462 Oral Care of the Aging and Chronically Ill *(I, 3)*
464 Field Experience in Community Oral Health *(II, 3)*

Genetics Courses

Botany
554 Cytogenetics
579 Advanced Genetics Seminar

Microbiology
552 Microbial Genetics

Plant Science
472 Plant Improvement

Zoology
518 Mechanisms of Development
573 Developmental Genetics
576 Ecological Genetics
579 Advanced Genetics Seminar

Gerontology Courses

Human Development, Counseling, and Family Studies
420 Human Development during Adulthood
421 Death, Dying, and Bereavement
422 Aging: Case Coordination
431 Family and the Elderly
440 Environmental Context of Aging
520 Developmental Issues in Later Life
527 Health Care Policy and the Elderly
529 Practicum Seminar in Gerontology
555 Gerontological Counseling

Human Science and Services
530 Multidisciplinary Health Seminars for the Elderly

Dental Hygiene
462 Oral Care for the Aging and/or Chronically Ill

Adult and Extension Education
575 Adult and Cooperative Extension Programming for Older Adults

Education
410 Seminar and Supervised Field Practicum in Education of the Aging

Nursing
563 Advanced Clinical Study of Nursing Practice in Gerontology

Physical Education
563 Physical Fitness Programs for the Middle Aged and Elderly
564 Physiology of Aging

Recreation
416 Aging and Leisure

Sociology
438 Aging in Society

JOR Courses
Journalism

400 Opinion and Interpretation in Journalism *(II, 3)*
434 Mass Media Issues *(I and II, 3)*
438 Mass Media Law *(I and II, 3)*
442 Independent Study and Projects in Mass Communications *(I and II, 1–3)*
452 Public Relations *(I, 3)*
461 Internships in Print Journalism *(I and II, 3)*
462 Internships in Broadcasting *(I and II, 3)*

LAR Courses
Landscape Architecture

444 Landscape Architecture Studio III *(I, 3)*
454 (or PLS 454) Identification of Basic Ornamental Plants *(II, 3)*

Latin American Studies Courses

Anthropology
470 Problems in Anthropology

History
580 Colloquium in Latin American History

Political Science
431 International Relations

Portuguese
497, 498 Directed Study

Spanish
487 Modern Spanish-American Narrative
497, 498 Directed Study
571 Modern Spanish-American Authors
572 Evolution of Spanish-American Culture and Thought
590 The Hispanic Presence in the United States

NES Courses
New England Studies

400, 401, 402, 403 Special Topics in New England Studies *(SS, 1–3 each)*

500 Readings in New England Experience *(SS, 3)* Life in New England through the varying disciplines of the social sciences, the physical sciences, the humanities, and the arts. Each student will investigate a specific aspect of New England. *(Lec. 3)* Staff

RTH Courses
Respiratory Therapy

499 Special Problems *(I and II, 1–3)*

SPE Courses
Speech Communication

400 Rhetoric *(I, 3)*
410 Semantics *(II, 3)*
415 The Ethics of Persuasion *(II, 3)*
420 Seminar in American Public Address and Criticism *(II, 3)*
430 Political Communication *(I, 3)*
435 Directing Group Performance of Nondramatic Literature *(II, 3)*
440 Telecommunications Processes and Audience Behavior *(I and II, 3)*
450 Organizational Communication *(I and II, 3)*
460 Communication and Conflict Intervention *(II, 3)*
471, 472 Internship in Speech Communication *(I and II, 3 each)*
491, 492 Special Problems *(I and II, 1–3 each)*

Statistics Courses

Economics
576 Econometrics

Electrical Engineering
584 Pattern Recognition

Experimental Statistics
407 Introductory Biostatistics
409 Statistical Methods in Research I
412 Statistical Methods in Research II
413 Data Analysis
491 Directed Study in Experimental Statistics
492 Special Topics in Experimental Statistics
500 Nonparametric Statistical Methods
501 Analysis of Variance and Variance Components
502 Applied Regression Analysis
517 Small N Designs
520 Fundamentals of Sampling and Applications
532 Experimental Design
541 Multivariate Statistical Methods
542 Discrete Multivariate Methods
550 Ecological Statistics
576 Econometrics
584 Pattern Recognition
591 Directed Study in Experimental Statistics
592 Special Topics in Experimental Statistics
610 Parsimony Methods
611 Linear Statistical Models
612 Structural Modeling
635 Response Surfaces and Evolutionary Operations

Industrial and Manufacturing Engineering
411 Probability for Engineers
412 Statistics for Engineers
455 Managerial Applications of Simulation
513 Statistical Quality Control
533 Advanced Statistical Methods for Research and Industry
634 Design and Analysis of Industrial Experiments
635 Response Surfaces and Evolutionary Operations

Management Science
450 Forecasting: Computer Applications
470 Managerial Decision Support Systems
475 Bayesian Statistics in Business
530 Statistics for Management
601, 602 Advanced Management Statistics
630 Management Statistics with SAS and Personal Computer Software
671 Methods of Business Research
683 Business Decision Theory

Mathematics
451 Introduction to Probability and Statistics
452 Mathematical Statistics
456 Probability
550 Advanced Probability
551 Mathematical Statistics

Mechanical Engineering and Applied Mechanics
521 Reliability Analysis and Prediction

Psychology
517 Small N Designs
533 Advanced Quantitative Methods in Psychology
610 Parsimony Methods
612 Structural Modeling

Resource Economics
576 Econometrics

URB Courses
Urban Affairs

498, 499 Urban Affairs Senior Seminar *(I and II, 3 each)*

WMS Courses
Women's Studies

400 Critical Issues and Feminist Scholarship *(I or II, 3)*

PERSONNEL

The Graduate School

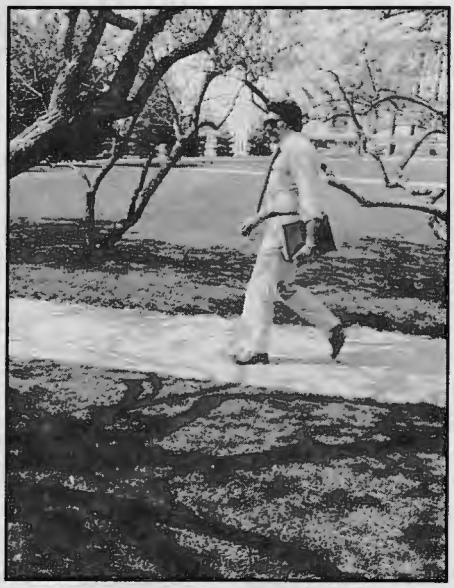
Morrison, J. Kent, *Acting Dean*
Rose, Vincent C., *Associate Dean*
Turcotte, Robert B., *Assistant to the Dean*
Onosko, Joan M., *Executive Assistant*

The Graduate Council

Morrison, J. Kent, *Chairperson, Ex Officio*
Badejo, Diedre, *Arts and Sciences (1991)*
Bibb, Harold D., *Arts and Sciences (1990)*
Cameron, Lucille W., *Library (1992)*
Cullen, John, *Business Administration (1991)*
Futas, Elizabeth, *Arts and Sciences (1991)*
Garey, Marion, *Nursing (1991)*
Giddins, Mary D., *Graduate School, Pharmaceutics (1990)*
Grubman-Black, *Stephen D., Human Science and Services (1992)*
Harlin, Marilyn M., *Arts and Sciences (1992)*
Harlow, Lisa, *Arts and Sciences (1990)*
Hull, Richard, *Resource Development (1990)*
Moran, Charles, *Vice President, GSA, MBA (1990)*
Nixon, Dennis W., *Arts and Sciences (1990)*
Nota, Andrew E., *Graduate Student, MBA (1990)*
Rosenbaum, Sara, *Pharmacy (1992)*
Smayda, Theodore J., *Oceanography (1991)*
Tsiatas, George E., *Engineering (1992)*
Vukina, Tomislav, *Graduate Student, Resource Economics (1990)*

Academic Administrators

Eddy, Edward D., *President*
Gitlitz, David M., *Provost*
Morrison, J. Kent, *Dean of the Graduate School*
Duce, Robert A., *Dean of the Graduate School of Oceanography*
Luzzi, Louis A., *Dean of the College of Pharmacy*
Gelles, Richard J., *Dean of the College of Arts and Sciences*
Clagett, Robert P., *Dean of the College of Business Administration*
Viets, Hermann, *Dean of the College of Engineering*
Brittingham, Barbara, *Dean of the College of Human Science and Services*
Miller, Jean, *Dean of the College of Nursing*
Miller, Robert H., *Dean of the College of Resource Development*
Strommer, Diane W., *Dean of the University College and Director of Special Academic Programs*
Crocker, Walter A., Jr., *Dean of the College of Continuing Education*
Young, Arthur P., *Dean, University Libraries*
Taggart, David G., *Dean, Undergraduate Admissions and Student Financial Aid*



Board of Governors for Higher Education

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John F. McBurney *(Senator)*
Henry J. Nardone
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Americo W. Petrocelli, *Commissioner of Higher Education*
Mary E. Kennard, *Legal Counsel*

Graduate Faculty

First date after title indicates appointment to present position; the second date, when the first fails to do so, indicates first appointment in the University.

Abell, Paul I., Professor of Chemistry, 1964, 1951.
Abushanab, Elie, Professor of Medicinal Chemistry and Chemistry, 1979, 1970.
Ageloff, Roy, Associate Professor of Management Science, 1977, 1972.
Albert, Luke S., Professor of Botany, 1970, 1960.
Alexander, Lewis M., Professor of Geography, 1960.
Alm, Steven R., Assistant Professor of Plant Sciences, Cooperative Extension Service, 1987.
Anderson, James L., Assistant Professor of Resource Economics, 1983.
Anderson, Joan Gray, Assistant Professor of Consumer Studies and Human Development, Counseling, and Family Studies, 1984.
Anderson, Judith L., Professor of Speech Communication, 1982, 1970.
Andrews, Emily S., Associate Professor of Labor and Industrial Relations, 1989.
Arakelian, Paul G., Associate Professor of English, 1981, 1976.
Armstrong, Charles P., Professor of Management Science, 1981, 1971.
Aronian, Sona, Professor of Russian and Women's Studies, 1987, 1970.
Arthur, Michael A., Professor of Oceanography, 1989, 1983.
Atash, Farhad, Assistant Professor of Community Planning and Area Development, 1986, 1985.
August, Peter V., Associate Research Professor of Natural Resources Science, 1989, 1985.
Bablenis, Elena, Assistant Professor of Pharmacy, 1988.
Babson, John R., Assistant Professor of Pharmacology and Toxicology, 1988.
Badejo, Diedre, Associate Professor of English, 1989, 1984.
Barker, Walter L., Associate Professor of English, 1973, 1966.
Barnett, Harold, Professor of Economics, 1986, 1970.
Barnett, Stanley M., Professor of Chemical Engineering, Food Science and Technology, and Pharmaceutics, 1980, 1969.
Barron, Robert A., Assistant Professor of Mathematics, 1956.
Bartel, Virginia B., Assistant Professor of Education, 1989.
Baudet, Gerard M., Associate Professor of Computer Science, 1987.
Beaupre, Walter J., Professor of Communicative Disorders, 1968.
Beauregard, Raymond A., Professor of Mathematics, 1982, 1968.
Beauvais, Laura, Assistant Professor of Management, 1984.
Beckman, Carl H., Professor of Plant Sciences, Emeritus, 1969, 1963.
Bender, Michael L., Professor of Oceanography, 1982, 1972.
Bengston, David A., Assistant Research Professor of Zoology, 1989.
Beretta, David, Chairman of the Board, Uniroyal Inc. (Retired), Executive in Residence, 1982.
Berman, Allan, Professor of Psychology, 1976, 1968.
Bibb, Harold D., Associate Professor of Zoology, 1978, 1972.
Biller, Henry B., Professor of Psychology, 1975, 1970.
Blackman, Nancy, Associate Professor of Human Development, Counseling, and Family Studies, 1983, 1977.
Bloomquist, Lorraine C., Professor of Physical Education, 1985, 1967.
Bonner, Jill C., Professor of Physics, 1981, 1976.
Boothroyd, Geoffrey, Professor of Industrial and Manufacturing Engineering, 1985.

Boothroyd, Jon C., Professor of Geology, 1986, 1975.
Bose, Arijit, Associate Professor of Chemical Engineering, 1987, 1982.
Boudreaux-Bartels, Gloria F., Associate Professor of Electrical Engineering, 1988, 1983.
Boulmetis, John, Assistant Professor of Education, 1982, 1977.
Boyle, Edmund, Instructor of Accounting, 1988.
Bradley, Terence M., Associate Professor of Fisheries, Animal and Veterinary Science, 1989, 1983.
Brady, Susan A., Associate Professor of Psychology, 1989, 1982.
Bridges, Christine, Assistant Professor of Nursing, 1988.
Briggs, Josiah M., Professor of History, 1975, 1969.
Brittingham, Barbara, Dean, College of Human Science and Services and Associate Professor of Education, 1986, 1973.
Brown, Christopher W., Professor of Chemistry, 1976, 1968.
Brown, George A., Professor of Mechanical Engineering and Applied Mechanics, 1966.
Brown, James H., Jr., Professor of Natural Resources Science, 1980, 1958.
Brown, Phyllis R., Professor of Chemistry, 1980, 1973.
Brown, Richard, Associate Professor of Materials and Chemical Engineering, 1985, 1981.
Brownell, Winifred E., Professor of Speech Communication, 1988, 1971.
Budnick, Frank S., Professor of Management Science, 1982, 1971.
Bullock, Robert C., Associate Professor of Zoology, 1978, 1974.
Bumpus, Marguerite, Acting Vice President for Student Development and Professor of Education, 1981, 1969.
Burke, Sally F., Assistant Professor of English, 1972, 1967.
Burkett, John P., Associate Professor of Economics, 1986, 1981.
Burroughs, Richard, Associate Professor of Marine Affairs, 1989, 1983.
Cabelli, Victor J., Professor of Microbiology, 1979.
Cain, J. Allan, Professor of Geology, 1971, 1966.
Caldwell, Marjorie J., Associate Professor of Food Science and Nutrition, 1980, 1972.
Caldwell, Roderick, P.C., Associate Professor of Mathematics, Emeritus, 1984, 1962.
Cameron, Lucille, Associate Professor, Library, 1982, 1970.
Campbell, Josie P., Professor of English in the College of Continuing Education, 1985, 1972.
Campbell, Norman A., Professor of Pharmacy Administration, 1976, 1970.
Cane, Walter, Associate Professor of English in the College of Continuing Education, 1974, 1967.
Carey, Steven N., Assistant Research Professor of Oceanography, 1987.
Carney, Edward J., Professor of Computer Science and Statistics, 1974, 1967.
Carrano, Frank M., Associate Professor of Computer Science, 1975, 1969.
Carroll, Leo, Professor of Sociology, 1982, 1972.
Carson, Herbert, Assistant Professor of Library and Information Studies, 1986.
Casagrande, Richard A., Professor of Plant Pathology-Entomology, 1989, 1976.
Castro, Concepcion Y., R.N., Associate Professor of Nursing, 1977, 1969.
Censullo, Meredith, Associate Professor of Nursing, 1988.
Ceo, Joseph S., Professor of Music, 1980, 1976.
Chandlee, Joel M., Assistant Professor of Plant Sciences, 1988.
Cerny, Catherine A., Assistant Professor of Textiles, Fashion Merchandising, and Design, 1986.
Chandlee, Joel M., Assistant Professor of Plant Sciences, 1988.
Chang, Pei Wen, Professor of Fisheries, Animal and Veterinary Science, 1982, 1955.
Chang, Rosita P., Associate Professor of Finance and Insurance, 1988, 1982.
Chartier, Armand B., Professor of French, 1988, 1971.
Cheer, Clair J., Professor of Chemistry, 1983, 1968.
Chen, Ching-Shih, Assistant Professor of Pharmacognosy, 1987.
Chen, Shaw K., Assistant Professor of Management Science, 1988, 1986.
Cheer, Clair J., Professor of Chemistry, 1983, 1968.
Chichester, Clinton O., Professor of Food Science and Nutrition, Emeritus, 1970.
Chichester, Clinton O. III, Associate Professor of Pharmacology and Toxicology, 1987, 1981.
Christner, Anne M., Assistant Professor of Consumer Studies, Human Development, Counseling, and Family Studies, 1977, 1974.
Clagett, Robert P., Dean of the College of Business Administration, 1985.
Clark, Dean, S., Associate Professor of Mathematics, 1988, 1984.
Clark, Phillip G., Associate Professor of Human Development, Counseling, and Family Studies, 1987, 1981.
Coates, Norman, Director of Institute for International Business and Professor of Management, 1971.
Cobb, J. Stanley, Professor of Zoology, 1981, 1970.
Cohen, Greta L., Associate Professor of Physical Education, 1975, 1966.
Cohen, Jerry L., Professor of Psychology, 1989, 1980.
Cohen, Joel A., Professor of History, 1979, 1965.
Cohen, Paul S., Professor of Microbiology, 1975, 1966.
Cohen, Stewart, Professor of Human Development, Counseling, and Family Studies, 1978, 1972.
Collyer, Charles E., Associate Professor of Psychology, 1981, 1976.
Comerford, Robert A., Associate Dean of the College of Business Administration and Professor of Management, 1985, 1975.
Constantinides, Spiros M., Deputy Director of the International Center for Marine Resource Development and Professor of Food Science and Nutrition, and Biochemistry, 1974, 1968.
Cooper, Elizabeth A., Assistant Professor of Management, 1985.
Cornillon, Peter C., Associate Professor of Oceanography and Ocean Engineering, 1983, 1981.
Cosgrove, Clifford, Professor of Food Science and Nutrition, 1974, 1953.
Costantino, Robert F., Professor of Zoology, 1978, 1972.
Costigliola, Frank, Professor of History, 1985, 1972.
Croasdale, William, Professor of Education, 1982, 1965.
Crooker, Jeannette E., Associate Professor of Physical Education, 1967, 1955.
Cruickshank, Alexander Middleton, Professor of Chemistry, Emeritus, 1969, 1953.
Cuddy, Lois, Professor of English, 1989, 1978.
Culatta, Barbara, Professor of Communicative Disorders, 1989, 1983.
Cullen, John Brooks, Associate Professor of Management, 1988.
Dain, Joel A., Professor of Biochemistry, 1973, 1962.
Daly, James C., Professor of Electrical Engineering, 1983, 1969.
Daniel, Charles E., Jr., Assistant Professor of History, 1968, 1967.
Dash, Gordon H., Jr., Associate Professor of Finance, 1979, 1974.
Datseris, Philip, Professor of Mechanical Engineering and Applied Mechanics, 1989, 1977.
Datta, Dilip K., Professor of Mathematics, 1981, 1967.
DeAlteris, Joseph T., Associate Professor of Fisheries, Animal and Veterinary Science, 1989, 1983.
DeFanti, David R., Professor of Pharmacology and Director of Crime Laboratory, 1973, 1961.
DeFeo, John J., Professor of Pharmacology, Emeritus, 1965, 1957.
Della Bitta, Albert J., Director of Research Center in Business and Economics and Professor of Marketing, 1981, 1971.
deLodzia, George, Professor of Management, 1975, 1970.
DeLuise, Frank, Professor of Mechanical Engineering and Applied Mechanics, 1979, 1950.
Dempsey, John D., Professor of Music, 1982, 1973.

Desjardins, J. Scott, Professor of Physics, 1976, 1960.
Detrick, Robert S., Jr., Professor of Oceanography, 1987, 1979.
Dewhurst, Peter, Professor of Industrial and Manufacturing Engineering, 1985.
Dholakia, Nikhilesh, Professor of Marketing, 1984, 1981.
Dholakia, Ruby Roy, Professor of Marketing, 1984, 1981.
Diaz-Miranda, Mariano, Assistant Professor of History, 1989, 1987.
Disney, Diane M., Assistant Professor of Management, 1988.
Donnelly, Dorothy F., Professor of English, 1985, 1965.
Dornberg, Otto, Professor of German, 1983, 1963.
Dougherty, John J., Assistant Professor of Biochemistry, 1984.
Driver, Rodney D., Professor of Mathematics, 1974, 1969.
Duce, Robert A., Dean of the Graduate School of Oceanography, Vice Provost for Marine Affairs, Director, Center for Atmospheric Chemistry Studies, and Professor of Oceanography, 1981, 1970.
Dudley, Michael N., Associate Professor of Pharmacy, 1988, 1983.
Duff, Dale T., Associate Professor of Plant Sciences, 1975, 1967.
Dunn, John, Assistant Professor of Management, 1983.
Durbin, Ann G., Associate Research Professor of Oceanography, 1982, 1980.
Durbin, Edward G., Associate Research Professor of Oceanography, 1982, 1980.
Dvorak, Wilfred P., Associate Professor of English, 1981, 1968.
Dymsza, Henry A., Professor of Food Science and Nutrition, 1970, 1966.
Ebrahimpour, Maling, Assistant Professor of Management Science, 1984.
Eddleman, William R., Assistant Professor of Natural Resources Science, 1988.
Eddy, Edward D., President and University Professor, 1983.
Englander, Larry, Associate Professor of Plant Pathology–Entomology, 1981, 1972.
English, Catherine, Assistant Professor of Food Science and Nutrition, 1985.
Eshleman, Ruth E., Associate Professor of Food Science and Nutrition, 1976.
Estrin, Joseph, Professor of Chemical Engineering, 1980.
Euler, William B., Associate Professor of Chemistry, 1988, 1982.
Faghri, Mohammad, Associate Professor of Mechanical Engineering and Applied Mechanics, 1983.
Fasching, James L., Professor of Chemistry, 1979, 1969.
Fastovsky, David E., Assistant Professor of Geology, 1986.
Feld, Marcia, Professor of Community Planning and Area Development, 1988, 1975.
Feldman, Marshall, Assistant Professor of Community Planning and Area Development, 1987.
Fernhall, Bo, Assistant Professor of Physical Education, 1987.
Ferrante, William R., Justin Smith Morrill Professor of Mechanical Engineering and Applied Mechanics, 1972, 1956.
Findlay, James F., Jr., Professor of History, 1971.
Finizio, Norman J., Associate Professor of Mathematics, 1975, 1963.
Fischer, Godi, Assistant Professor of Electrical Engineering, 1985.
Fisher, Harold W., Professor of Biophysics, Biochemistry, and Microbiology, 1968, 1963.
Fitzelle, George T., Professor of Human Development, Counseling, and Family Studies, Emeritus,1969, 1959.
Florin, Paul Richard, Associate Professor of Psychology, 1987, 1981.
Forcé, R. Ken, Associate Professor of Chemistry, 1983, 1975.
Fortin, Jacqueline D., R.N., Associate Professor of Nursing, 1985, 1975.
Foster, Howard H., Jr., Associate Professor of Community Planning and Area Development, 1973, 1963.
Fox, Paul J., Research Professor of Oceanography, 1984, 1981.
Fraleigh, John B., Professor of Mathematics, 1978, 1962.
Freeman, David L., Professor of Chemistry, 1988, 1976.
Frohlich, Reinhard K., Associate Professor of Geology, 1979, 1973.
Fuchs, Henry C., Professor of Music, 1985, 1968.
Futas, Elizabeth, Professor of Library and Information Studies, 1986.
Garey, Marion, Associate Professor of Nursing, 1985.
Gates, John M., Professor of Resource Economics, 1982, 1969.
Gelles, Richard J., Dean of the College of Arts and Sciences and Professor of Sociology, 1984, 1973.
Gerber, Leonard E., Assistant Professor of Food Science and Nutrition, 1981.
Gersuny, Carl, Professor of Sociology, 1977, 1968.
Ghonem, Hamouda, Professor of Mechanical Engineering, 1986, 1981.
Gibbs, Geoffrey D., Professor of Music, 1983, 1965.
Gitlitz, David M., Provost and Professor of Spanish, 1988.
Goertemiller, Christian, Jr., Professor of Zoology, 1977.
Gold, Arthur J., Associate Professor of Natural Resources Science, 1988, 1983.
Goldman, Mark I., Professor of English, 1970, 1958.
Goldsmith, Marian R., Associate Professor of Zoology, 1983, 1980.
Golet, Francis C., Associate Professor of Natural Resources Science, 1978, 1972.
Goodman, Leon, Professor of Chemistry, Emeritus, 1970.
Goos, Roger D., Professor of Botany, 1972, 1970.
Gray, Donald J., Associate Professor of Chemical Engineering, 1987, 1980.
Gray, H. Glenn, Associate Professor of Fisheries, Animal and Veterinary Science, 1982, 1969.
Grebstein, Lawrence C., Professor of Psychology, 1975, 1964.
Greene, Helen Finch, Associate Professor of Human Development, Counseling, and Family Studies, Emerita, 1985, 1971.
Gregory, Otto J., Associate Professor of Chemical Engineering, 1988, 1982.
Grigalunas, Thomas A., Professor of Resource Economics, 1984, 1971.
Groffman, Peter M., Assistant Professor of Natural Resources Science, 1987.
Gross, Ira, Professor of Psychology and Women's Studies, 1983, 1967.
Grossman, Mark, Assistant Professor of Labor and Industrial Relations, 1986.
Grove, Edward A., Professor of Mathematics, 1988, 1968.
Grubman-Black, Stephen D., Associate Professor of Communicative Disorders, 1977, 1972.
Gullason, Thomas A., Professor of English, Emeritus, 1987, 1954.
Gunning, Thomas J., Associate Professor of Human Development, Counseling, and Family Studies, 1973, 1961.
Gutchen, Robert M., Professor of History, 1976, 1964.
Hagist, Warren M., Professor of Mechanical Engineering and Applied Mechanics, 1977, 1951.
Hammadou, JoAnne, Assistant Professor of Languages, 1988.
Hammen, Carl S., Professor of Zoology, 1971, 1963.
Hanke, John W., Professor of Philosophy, 1983, 1966.
Hanumara, R. Choudary, Professor of Statistics, 1988, 1968.
Hardy, Margaret, Professor of Nursing, 1985.
Hargraves, Paul E., Professor of Oceanography and Botany, 1987, 1968.
Harlin, Marilyn, Professor of Botany, 1983, 1971.
Harlow, Lisa L., Assistant Professor of Psychology, 1985.
Harrison, Robert W., Professor of Zoology, Emeritus, 1965, 1949.
Hartman, Karl A., Professor of Biophysics, 1976, 1967.
Hartt, Kenneth L., Professor of Physics, 1983, 1966.
Heikes, Brian G., Assistant Professor of Oceanography, 1988.
Helms, Patricia A., Associate Professor of Textiles, Fashion Merchandising, and Design, 1976, 1971.
Heltshe, James F., Professor of Statistics, 1985, 1973.
Hemmerle, William, Professor of Computer Science and Statistics, Emeritus, 1965.
Hennessey, Timothy M., Professor of Political Science, 1978, 1976.
Heppner, Frank H., Professor of Zoology, 1979, 1969.
Hermes, O. Don, Professor of Geology, 1978, 1968.

Heskett, David, Assistant Professor of Physics, 1988.
Hetzner, C.N., Assistant Professor of Management, 1983.
Hickox, Charles, Assistant Professor of Business Law, 1985.
Higa, Misako, Associate Professor of Textiles, Fashion Merchandising, and Design, 1984, 1977.
Hill, Robert B., Professor of Zoology, 1975, 1968.
Hills, Mathilda M., Associate Professor of English, 1977, 1970.
Hirsch, Janet I., R.N., Professor of Nursing, 1983, 1971.
Holmsen, Andreas, Professor of Resource Economics, Emeritus, 1970, 1963.
Honhart, Michael W., Assistant Professor of History, 1972, 1971.
Horm-Wingerd, Diane M., Assistant Professor of Human Development, Counseling, and Family Studies, 1987.
Hu, James, Assistant Professor of Ocean Engineering, 1984.
Huebert, Barry J., Professor of Oceanography, 1987.
Hufnagel, Linda A., Professor of Microbiology, 1986, 1973.
Hull, Richard J., Professor of Plant Science, 1979, 1969.
Hume, Anne L., Assistant Professor of Pharmacy Practice, 1985.
Humphrey, Alan B., Associate Professor of Management Science, 1978.
Hurley, Raymond M., Associate Professor of Communicative Disorders, 1982, 1976.
Husband, Thomas P., Associate Professor of Natural Resources Science, 1983, 1977.
Hutton, Lewis J., Professor of Hispanic Studies, 1973, 1966.
Hyland, Kerwin E., Jr., Professor of Zoology, 1966, 1953.
Jackson, Leland B., Professor of Electrical Engineering, 1979, 1974.
Jackson, Noel, Professor of Plant Pathology–Entomology, 1975, 1965.
Jacobs, Dorothy, Associate Professor of English, 1984, 1968.
Jarrett, Jeffrey E., Professor of Management Science, 1974, 1971.
Jeffries, Harry P., Professor of Oceanography, 1973, 1959.
Jensen, Patricia, Assistant Professor of Library and Information Studies, 1978.
Johnson, Diane, Assistant Professor of Mathematics, 1988.
Johnson, Eugene M., Professor of Marketing Management, 1975, 1971.
Johnson, Galen A., Professor of Philosophy, 1987, 1976.
Johnson, Jean L., Assistant Professor of Marketing, 1988.
Johnson, William C. II, Assistant Professor of Chemistry, 1984.
Joseph, Dayle Hunt, R.N., Assistant Dean of the College of Nursing and Professor of Nursing, 1976, 1973.
Juda, Lawrence, Professor of Marine Affairs, 1984, 1977.
Kahn, Leonard N., Associate Professor of Physics, 1984, 1980.
Karamanlidis, Dimitrios, Assistant Professor of Civil and Environmental Engineering, 1983.
Kaskosz, Barbara, Associate Professor of Mathematics, 1987.
Kass-Simon, Gabriele, Associate Professor of Zoology, 1978, 1973.
Kaufman, Charles, Professor of Physics, 1983, 1964.
Kay, Steven M., Associate Professor of Electrical Engineering, 1984, 1980.
Keeling, Kenneth, Professor of Music, 1986.
Kellogg, Theodore M., Associate Professor of Education, 1976, 1970.
Kent, George E., Professor of Music, 1980, 1969.
Kester, Dana R., Professor of Oceanography, 1976, 1969.
Ketrow, Sandra M., Assistant Professor of Speech Communication, 1986.
Killilea, Alfred G., Professor of Political Science, 1980, 1969.
Killingbeck, Keith T., Associate Professor of Botany, 1984, 1979.
Kim, Chai, Professor of Management Science, 1981.
Kim, Chong Sun, Professor of History, 1979, 1965.
Kim, Hesook Susie (Kang), R.N., Professor of Nursing, 1983, 1973.
Kim, Thomas Joon-Mock, Professor of Mechanical Engineering and Applied Mechanics, 1979, 1968.
Kim, Yong Choon, Professor of Philosophy, 1979, 1971.
King, John, Assistant Research Professor of Oceanography, 1984.
Kirschenbaum, Louis J., Professor of Chemistry, 1983, 1970.
Kislalioglu, Serpil, Associate Professor of Pharmaceutics, 1988.
Klein, Maurice N., Professor of History, 1973, 1964.
Knauss, John A., Professor of Oceanography and Marine Affairs, 1962.
Knickle, Harold N., Professor of Chemical Engineering, 1982, 1969.
Knight, Winston A., Professor of Industrial and Manufacturing Engineering, 1985.
Kohlbecker, Eugene E., Jr., Assistant Professor of Computer Science, 1987.
Koske, Richard E., Associate Professor of Botany, 1983, 1978.
Kovacs, William D., Professor of Civil Engineering, 1984.
Kowalski, James G., Associate Professor of Philosophy, 1978, 1971.
Kowalski, Tadeusz, Professor of Ocean Engineering, 1976, 1969.
Koza, Russell C., Professor of Management Science, 1979, 1977.
Krausse, Gerald H., Assistant Professor of Geography, 1975, 1973.
Krueger, William H., Associate Professor of Zoology, 1973, 1964.
Krul, William R., Associate Professor of Plant Science, 1977.
Kuhn, Ira A., Associate Professor of French, 1977, 1967.
Kulberg, Janet, Professor of Psychology, 1989.
Kumaresan, Ramdas, Assistant Professor of Electrical Engineering, 1983.
Kunz, Don R., Professor of English, 1982, 1968.
Kupa, John J., Associate Professor of Community Planning and Area Development, 1969, 1963.
Kyllo, Karen, Assistant Professor of Textiles, Fashion Merchandising, and Design, 1986.
Ladas, Gerasimos, Professor of Mathematics, 1975, 1969.
Ladewig, James, Associate Professor of Music, 1989, 1987.
Lamagna, Edmund A., Associate Professor of Computer Science, 1982, 1976.
Lardaro, Leonard P., Associate Professor of Economics, 1987, 1981.
Larson, Roger L., Professor of Oceanography, 1980.
Latos, Charles, Assistant Professor of Economics, College of Continuing Education, 1977, 1969.
Lausier, Joan M., Professor of Pharmaceutics, 1986, 1971.
Laux, David C., Professor of Microbiology, 1984, 1973.
Laviano, Andrew, Associate Professor of Business Law, 1982, 1978.
Lawing, William D., Jr., Associate Professor of Industrial Engineering and Experimental Statistics, 1969.
LeBlanc, Lester R., Professor of Ocean Engineering, 1980, 1971.
LeBrun, Roger A., Associate Professor of Plant Sciences, 1983, 1977.
Leduc, Edgar C., Professor of Political Science, 1976, 1969.
Lee, Chong-Min, Professor of Food Science and Nutrition, 1988, 1980.
Lee, Kang W., Associate Professor of Civil Engineering, 1988, 1985.
Leinen, Margaret S., Professor of Oceanography and Associate Dean of the Graduate School of Oceanography, 1989, 1982.
Lengyel, Gabriel, Professor of Electrical Engineering, 1971, 1966.
Leo, John R., Associate Professor of English in the College of Continuing Education, 1983, 1973.
Lessmann, Richard C., Professor of Mechanical Engineering, 1983, 1969.
Lessne, Greg J., Associate Professor of Marketing, 1989, 1983.
Letcher, Stephen V., Professor of Physics, 1975, 1963.
Lewis, James T., Professor of Mathematics, 1981, 1969.
Lie, Chin-Jen, Assistant Professor of Finance and Insurance, 1988.
Lindgren, Allen G., Professor of Electrical Engineering, 1970, 1964.
Liu, Pan-Tai, Professor of Mathematics, 1979, 1968.
Logan, Patrick A., Associate Professor of Plant Pathology–Entomology, 1987, 1977.
Long, John V., Jr., Professor of Education, 1979, 1971.

Lord, Blair M., Associate Professor of Finance and Insurance, 1981, 1976.
Lott, Albert J., Professor of Psychology, 1969.
Lott, Bernice, Professor of Psychology and Women's Studies, 1975, 1970.
Loy, James D., Professor of Anthropology, 1984, 1974.
Luzzi, Louis A., Dean of the College of Pharmacy, and Professor of Pharmacy, 1981.
MacLaine, Allan H., Professor of English, 1962.
MacMillan, Robert W., Professor of Education, 1979, 1966.
Malik, Surendra, Professor of Physics, 1974, 1962.
Malina, Marilyn J., Associate Professor of English, 1977, 1967.
Mallilo, Anthony T., Assistant Professor of Resource Development Education, 1982.
Manfredi, Thomas G., Professor of Physical Education, 1988, 1982.
Mangiameli, Paul M., Associate Professor of Management Science, 1984, 1977.
Manteiga, Robert, Professor of Hispanic Studies, 1988, 1976.
Marcus, Alan S., Associate Professor of Civil and Environmental Engineering, 1977, 1969.
Mardix, Shmuel, Professor of Electrical Engineering, 1978, 1970.
Marshall, James M., Professor of English, 1984, 1965.
Marshall, Nelson, Professor of Oceanography and Marine Affairs, Emeritus, 1984, 1959.
Marti, Bruce, Associate Professor of Marine Affairs, 1988, 1980.
Martin, Celest A., Associate Professor of English, 1984, 1979.
Martin, Spencer J., Professor of Accounting, 1980, 1970.
Maslyn, David C., University Archivist, Special Collections Librarian, and Professor, Library, 1983, 1974.
Mathews, Francis X., Professor of English, 1977, 1967.
Matoney, Joseph P., Jr., Professor of Accounting, 1983, 1973.
Mattea, Edward J., Associate Professor of Pharmacy, 1980, 1974.
Maynard, Peter E., Professor of Human Development, Counseling, and Family Studies, 1981, 1971.
McCabe, Thomas H., Associate Professor of English, 1974, 1965.
McEwen, Everett E., Professor of Civil Engineering, 1984, 1967.
McFarland, Marilyn E., Assistant Professor of Pharmacy, 1983.
McGrath, Margaret, R.N., Associate Professor of Nursing, 1989, 1985.
McGuire, John J., Professor of Plant Science, 1977, 1962.
McIntyre, Richard, Assistant Professor of Economics, 1989.
McKiel, Charles G., Associate Professor of Natural Resources, 1974, 1960.
McKinney, Wm. Lynn, Associate Professor of Education, 1984, 1972.
McLeavey, Dennis W., Professor of Management Science, 1982, 1976.
McMaster, Robert L., Professor of Oceanography, 1969, 1953.
McNab, Gregory R., Jr., Professor of Portuguese, 1989, 1971.
McNair, Carol J., Assistant Professor of Accounting, 1988.
McNamara, Michael, Assistant Professor of Finance and Insurance, 1988.
Mead, Arthur C., Associate Professor of Economics, 1984, 1976.
Meade, Thomas L., Professor of Fisheries, Animal and Veterinary Science, 1975, 1968.
Mensel, William L., Jr., Assistant Professor of English, 1973, 1969.
Merrill, John T., Associate Research Professor of Oceanography, 1987.
Merenda, Peter F., Professor of Psychology and Statistics, Emeritus, 1985, 1960.
Metz, William D., Professor of History, Emeritus, 1983, 1945.
Meyerovich, Alexander E., Associate Professor of Physics, 1989.
Michel, Aloys A., Professor of Geography and Regional Planning, 1967, 1966.
Middleton, Foster H., Professor of Ocean Engineering, Emeritus, 1961, 1959.
Milburn, Josephine F., Professor of Political Science and Women's Studies, 1977, 1970.
Millar, Richard I., Associate Professor of Fisheries, Animal and Veterinary Science, 1974, 1967.
Miller, Carole F., Assistant Professor of Economics, 1988.
Miller, Jean R., Dean of the College of Nursing, and Professor of Nursing, 1988.
Miller, Jordan Y., Professor of English, Emeritus, 1985, 1969.
Miller, Robert H., Dean of the College of Resource Development, Director of the Cooperative Extension Service, and Professor of Natural Resources Science, 1989.
Mitra, Shashanka S., Professor of Electrical Engineering, 1965.
Mojena, Richard, Professor of Management Science, 1981, 1971.
Molloy, Scott, Assistant Professor of Labor and Industrial Relations, 1986.
Montgomery, John T., Professor of Mathematics, 1984, 1973.
Moore, Marjorie Ann, Assistant Professor of Physical Therapy, 1988.
Morello, Joseph G., Associate Professor of French, 1979, 1968.
Morin, Thomas D., Associate Professor of Hispanic Studies, 1980, 1975.
Morokoff, Patricia, Assistant Professor of Psychology, 1987.
Morrison, J. Kent, Dean of the Graduate School, 1989.
Morrisey, Michael, Assistant Professor of Food Science and Nutrition, 1989.
Morse, Kenneth T., Associate Professor, Library, 1975, 1973.
Mottinger, John P., Associate Professor of Botany and Zoology, 1974, 1968.
Mueller, Walter C., Professor of Plant Pathology–Entomology, 1974, 1961.
Muller, Gerhard, Associate Professor of Physics, 1987, 1984.
Murphy, Clare M., Professor of English, 1989, 1964.
Murphy, Teresa, Assistant Professor of History, 1983.
Murray, Daniel P., Associate Professor of Geology, 1989, 1983.
Napora, Theodore A., Assistant Dean for Students, Graduate School of Oceanography, and Associate Professor of Oceanography, 1972, 1958.
Nash, Charles D., Jr., Professor of Mechanical Engineering and Applied Mechanics, 1964.
Narasimhan, Seetharama, Professor of Management Science, 1984, 1979.
Navascués, Michael, Professor of Hispanic Studies, 1988, 1968.
Nedwidek, Raymond A., Professor of Physical Education, 1976, 1965.
Nelson, David R., Associate Professor of Microbiology, 1988, 1982.
Nelson, Richard G., Associate Professor of Education, 1978, 1972.
Nelson, Wilfred H., Professor of Chemistry, 1977, 1964.
Neuse, Richard T., Professor of English, 1970, 1956.
Nichols, Edward, Professor of Industrial Engineering, 1960, 1959.
Nightingale, M. Peter, Associate Professor of Physics, 1985, 1983.
Nippo, Murn M., Associate Professor of Fisheries, Animal and Veterinary Science, 1982, 1972.
Nixon, Dennis W., Associate Professor of Marine Affairs and Coordinator, Marine Affairs Program, 1987, 1976.
Nixon, Scott W., Professor of Oceanography and Director, URI Sea Grant Program, 1980, 1970.
Norris, Joanna Hanks, Assistant Professor of Botany and Microbiology, 1987.
Norris, John S., Assistant Professor of Physical Education, 1969.
Northby, Jan A., Professor of Physics, 1979, 1970.
Nunes, Anthony C., Professor of Physics, 1982, 1976.
O'Donnell, Leo E., Associate Professor of Physical Education, 1976, 1972.
Ohley, William J., Associate Professor of Electrical Engineering, 1982, 1976.
Okuda, Roy K., Assistant Professor of Pharmacognosy and Environmental Health Science, 1985.
O'Leary, John Louis, Associate Professor of Physical Education, 1976, 1957.
Olson, Daniel G., Assistant Professor of Mechanical Engineering, 1987.
Opaluch, James J., Associate Professor of Resource Economics, 1985, 1979.
Oppenheimer, Henry, Associate Professor of Finance and Insurance, 1988.
Overton, Craig E., Professor of Management, 1981, 1969.
Oviatt, Candace A., Research Professor of Oceanography, 1982, 1970.

Owens, Norma J., Associate Professor of Pharmacy, 1989, 1982.
Pakula, Lewis I., Associate Professor of Mathematics, 1978, 1973.
Palm, William J., Professor of Mechanical Engineering and Applied Mechanics, 1987, 1970.
Panzica, Raymond P., Professor of Medicinal Chemistry and Chemistry, 1986, 1976.
Pascale, Alfred C., Associate Professor of Human Development, Counseling, and Family Studies, Emeritus, 1985, 1965.
Pasquerella, Lynn, Assistant Professor of Philosophy, 1986.
Patric, Earl F., Professor of Natural Resources Science, 1974, 1969.
Pearlman, Daniel D., Professor of English, 1980.
Peck, Roger W., Assistant Professor of Statistics, 1984.
Penhallow, William S., Professor of Physics, 1986, 1959.
Peters, Calvin B., Associate Professor of Sociology, 1983, 1978.
Peterson, John F., Jr., Professor of Philosophy, 1979, 1964.
Peterson, Karen I., Assistant Professor of Chemistry, 1986.
Petrie, Paul J., Professor of English, 1969, 1959.
Pezzullo, Thomas R., Vice President for University Relations and Professor of Education, 1982, 1970.
Pickart, Stanley J., Professor of Physics, 1974.
Pilson, Michael E.Q., Professor of Oceanography, 1978, 1966.
Poggie, John J., Jr., Professor of Anthropology, 1975, 1969.
Polidoro, J. Richard, Associate Professor of Physical Education, Health, and Recreation, 1975, 1969.
Polk, Charles, Professor of Electrical Engineering, 1959.
Pollart, Gene J., Professor of Music, 1983, 1976.
Pollnac, Richard B., Professor of Anthropology, 1982, 1973.
Poon, Calvin Po-Chuen, Professor of Environmental Engineering, 1975, 1965.
Porter, Lambert C., Professor of French and Linguistics, Emeritus, 1981, 1961.
Potter, Nancy A., Professor of English, Emerita, 1963, 1947.
Pratt, David Mariotti, Professor of Oceanography, Emeritus, 1960, 1949.
Prochaska, James O., Professor of Psychology, 1977, 1969.
Purnell, Richard F., Professor of Education, 1977, 1970.
Quina, Kathryn, Associate Professor of Psychology, 1982, 1978.
Quinn, James G., Professor of Oceanography, 1978, 1968.
Rae, Gwenneth, Professor of Human Development, Counseling, and Family Studies, 1982, 1973.
Rahn, Kenneth A., Research Professor of Oceanography, 1983, 1980.
Ramsay, Glenworth A., Associate Professor of Economics, 1978, 1973.
Ramstad, Yngve, Associate Professor of Economics, 1988, 1982.
Rand, Arthur G., Jr., Professor of Food Science and Nutrition, 1975, 1963.
Rankin, W. Donald, Professor of Music, 1979, 1963.
Ravikumar, Bala, Assistant Professor of Computer Science, 1989.
Rayack, Elton, Professor of Economics, 1966, 1958.
Reaves, RB, Jr., Associate Professor of English, 1975, 1968.
Recksiek, Conrad W., Associate Professor of Fisheries, Animal and Veterinary Science, 1980.
Reilly, Mary E., Professor of Sociology, 1987, 1973.
Rhee, S. Ghon, Professor of Finance and Insurance, 1989, 1983.
Rhoads, Dennis E., Assistant Professor of Biochemistry, 1985.
Rhodes, Christopher T., Professor of Pharmaceutics, 1975.
Rhodes, Richard C. III, Associate Professor of Fisheries, Animal and Veterinary Science, 1987, 1982.
Rice, Michael A., Assistant Professor of Fisheries, Animal and Veterinary Science, 1987.
Richmond, Jayne E., Assistant Professor of Human Development, Counseling, and Family Studies, 1986.
Roberts, Mark, Assistant Professor of Philosophy, 1989.
Rockett, Thomas J., Professor of Materials and Chemical Engineering, 1982, 1971.
Rodgers, Robert L., Associate Professor of Pharmacology and Toxicology, 1987, 1981.
Rogers, Kenneth H., Professor of French and Linguistics, 1984, 1968.
Rorholm, Niels, Professor of Resource Economics, Emeritus, 1985, 1954.
Rose, Vincent C., Associate Dean of the Graduate School and Professor of Nuclear and Ocean Engineering, 1983, 1963.
Rosen, William M., Professor of Chemistry, 1982, 1970.
Rosenbaum, Sarah, Assistant Professor of Pharmaceutics, 1987.
Rosengren, William R., Professor of Sociology, 1968, 1967.
Rosie, Douglas M., Associate Provost, and Professor of Chemistry, 1972, 1958.
Rossby, Hans T., Professor of Oceanography, 1975.
Rossi, Joseph S., Research Assistant Professor of Psychology, 1985.
Rothschild, H. Dorothy, Professor of French, 1974, 1962.
Rothstein, Lawrence, Professor of Political Science, 1985, 1976.
Rothstein, Lewis, Associate Professor of Oceanography, 1989.
Rowinski, Mark J., Director of Physical Therapy Program, and Associate Professor of Physical Therapy, 1987.
Roworth, Wendy W., Professor of Art, 1988, 1976.
Roxin, Emilio O., Professor of Mathematics, 1967.
Russo, Francis X., Professor of Education, 1973, 1966.
Sadasiv, Angaraih G., Professor of Electrical Engineering, 1976, 1969.
Sadd, Martin H., Professor of Mechanical Engineering and Applied Mechanics, 1984, 1979.
Saila, Saul B., Professor of Oceanography and Zoology, Emeritus, 1967, 1956.
Schaffran, Jerome A., Associate Professor of Human Development, Counseling, and Family Studies, 1977, 1971.
Schilling, Jean-Guy, Professor of Oceanography, 1974, 1966.
Schmidt, Charles T., Jr., Director of Labor Relations Center and Professor of Industrial Relations, 1973, 1968.
Schneider, Stewart P., Associate Professor of Library Science, 1974, 1964.
Scholl, Richard W., Associate Professor of Management, 1984, 1979.
Schoonover, Eric T., Associate Professor of English, 1980, 1962.
Schroeder, Karen A., Assistant Professor of Human Development, Counseling, and Family Studies, 1972, 1968.
Schultz, Beatrice, Associate Professor of Speech Communication, 1984, 1981.
Schwartz-Barcott, Donna, R.N., Associate Professor of Nursing, 1979, 1975.
Schwartzman, Sol, Professor of Mathematics, 1983, 1969.
Schwarz, Stephen D., Professor of Philosophy, 1979, 1963.
Schwarzbach, Henry R., Professor of Accounting, 1988, 1976.
Schwegler, Robert A., Associate Professor of English, 1983, 1978.
Seigel, Jules P., Professor of English, 1976, 1965.
Seleen, Diane Rae, Associate Professor of Physical Education, 1982, 1971.
Shaikh, Zahir A., Professor of Pharmacology and Toxicology, 1986, 1982.
Shao, David M., Associate Professor of Industrial Engineering, 1976, 1969.
Sharif, Mohammed, Assistant Professor of Economics, 1984.
Shaw, Richard J., Associate Professor of Plant Sciences, 1976, 1970.
Shea, Gail A., Assistant Professor of Sociology and Anthropology and Women's Studies, 1975.
Sheath, Robert G., Professor of Botany, 1988, 1978.
Shen, Randolph F., Professor of Management Science, 1977, 1966.
Shimizu, Yuzuru, Professor of Pharmacognosy and Chemistry, 1977, 1969.
Shisha, Oved, Professor of Mathematics, 1976, 1974.
Shoop, C. Robert, Professor of Zoology, 1974, 1969.
Shukla, Arun, Professor of Mechanical Engineering and Applied Mechanics, 1988, 1981.

Sieburth, John McN., Professor of Oceanography and Microbiology, 1966, 1960.
Sigurdsson, Haraldur, Professor of Oceanography, 1980, 1974.
Siitonen, Leena, Assistant Professor of Library and Information Studies, 1987.
Silva, Armand J., Professor of Ocean and Civil Engineering, 1976.
Silverstein, Albert, Professor of Psychology, 1974, 1963.
Silvestri, Gino, Assistant Professor of History, 1969, 1965.
Simpson, Kenneth L., Professor of Food Science and Nutrition, 1972, 1964.
Sine, Robert C., Professor of Mathematics, 1977, 1971.
Singer, Jay, Associate Professor of Communicative Disorders, 1983, 1977.
Sink, Clay V., Professor of Management, 1982, 1969.
Skogley, Conrad Richard, Professor of Plant Sciences, 1970, 1960.
Smart, Mollie S., Professor of Child Development and Family Relations, Emerita, 1976, 1954.
Smart, Russell C., Professor of Child Development and Family Relations, Emeritus, 1976, 1953.
Smayda, Theodore J., Professor of Oceanography and Botany, 1970, 1959.
Smith, Charles I., Professor of Medicinal Chemistry, 1974, 1960.
Smith, Nelson F., Professor of Psychology, 1975, 1965.
Sonstroem, Robert J., Professor of Physical Education, Health, and Recreation, 1980, 1969.
Sorlien, Robert P., Professor of English, Emeritus, 1986, 1946.
Spaulding, Irving A., Professor of Resource Economics and Rural Sociology, Emeritus, 1960, 1949.
Spaulding, Malcolm L., Professor of Ocean Engineering, 1983, 1973.
Specker, Jennifer L., Associate Professor of Zoology, 1988, 1984.
Spence, Donald L., Director, Program in Gerontology and Professor of Human Development, Counseling, and Family Studies, Emeritus, 1982, 1973.
Spence, John E., Professor of Electrical Engineering, 1974, 1962.
Sperry, Jay F., Associate Professor of Microbiology, 1983, 1977.
Starkey, James L., Associate Professor of Economics, 1975, 1967.
Stauffer, Kenneth R., Assistant Professor of Food Science and Nutrition, 1979.
Steeves, Edna L., Professor of English, Emerita, 1980, 1967.
Stein, Arthur, Professor of Political Science, 1974, 1965.
Stein, Karen F., Associate Professor of English and Women's Studies, 1984, 1968.
Stepanishen, Peter R., Professor of Ocean Engineering, 1982, 1974.
Stevenson, John F., Professor of Psychology, 1989, 1973.
Steyerl, Albert, Professor of Physics, 1987.
Stineback, David C., Professor of English, 1982, 1977.
Strom, Sharon H., Professor of History, 1982, 1969.
Strommer, Diane W., Dean of University College and Special Academic Programs, and Adjunct Professor of English, 1980.
Sullivan, Richard E., Associate Professor of Education, 1988.
Sullivan, William Michael, Associate Professor of Plant Sciences, 1987, 1981.
Sunak, Harish R.B., Associate Professor of Electrical Engineering, 1985.
Sun, Ying, Assistant Professor of Electrical Engineering, 1985.
Surprenant, Carol F., Associate Professor of Marketing, 1988.
Suryanarayan, E. Ramnath, Professor of Mathematics, 1973, 1960.
Sutinen, Jon G., Professor of Resource Economics, 1988, 1973.
Suzawa, Gilbert S., Associate Professor of Economics, 1981, 1971.
Swallow, Stephen K., Assistant Professor of Resource Economics, 1988.
Swan, M. Beverly, Vice Provost, and Associate Professor of English, 1981, 1974.
Swaszek, Peter F., Associate Professor of Electrical Engineering, 1987, 1984.
Swift, Elijah V., Professor of Oceanography and Botany, 1980, 1969.
Swonger, Alvin K., Professor of Pharmacology and Toxicology, 1985, 1971.
Tabor, Amy, Assistant Professor of Labor and Industrial Relations, 1984.
Tate, Barbara, Ed.D., Dean, College of Nursing and Professor of Nursing, Emerita, 1983, 1969.
Taggart, David G., Instructor of Mechanical Engineering and Applied Mechanics, 1988.
Taubman, Albert H., Professor of Pharmacy Administration, 1986, 1982.
Test, Frederick L., Professor of Mechanical Engineering and Applied Mechanics, 1962, 1949.
Thiem, Leon T., Associate Professor of Civil and Environmental Engineering, 1989, 1983.
Thrasher, Kimberly, Assistant Professor of Pharmacy, 1987.
Thursby, Glen B., Research Assistant Professor of Botany, 1987.
Thurston, Gary, Professor of History, 1984, 1966.
Toloudis, Constantin, Associate Professor of French, 1977, 1966.
Towers, Tom H., Professor of English in the College of Continuing Education, 1979, 1971.
Traficante, Daniel D., Research Professor of Chemistry and Medicinal Chemistry, 1986.
Travisano, Richard V., Associate Professor of Sociology, 1986, 1969.
Traxler, Richard W., Professor of Food Science and Nutrition, 1971.
Tremblay, George C., Professor of Biochemistry, 1975, 1966.
Trivelli, Remo J., Professor of Italian, 1984, 1969.
Trostle, Susan L., Assistant Professor of Education, 1985.
Trubiano, Mario F., Associate Professor of Spanish, 1984, 1979.
Tryon, Jonathan S., Associate Professor of Library and Information Studies, 1977, 1969.
Tsiatas, George, Assistant Professor of Civil Engineering, 1988.
Tufts, Donald W., Professor of Electrical Engineering, 1967.
Turcotte, Joseph G., Professor of Medicinal Chemistry, 1977, 1967.
Tutt, Ralph M., Associate Professor of English, 1971, 1964.
Twombly, Saran, Assistant Professor of Zoology, 1987.
Tyce, Robert C., Associate Professor of Ocean Engineering and Oceanography, 1985, 1983.
Tyler, Gerry R., Associate Professor of Political Science, 1984, 1966.
Tyrrell, Timothy J., Associate Professor of Resource Economics, 1984, 1978.
Urish, Daniel W., Associate Professor of Civil and Environmental Engineering, 1986, 1978.
Vaccaro, Richard J., Associate Professor of Electrical Engineering, 1988, 1983.
Valentino, Dominic, Associate Professor of Psychology, 1978, 1973.
Vangermeersch, Richard, Professor of Accounting, 1979, 1971.
Velicer, Wayne F., Professor of Psychology, 1982, 1973.
Venkatesan, M., Professor of Marketing, 1988.
Verma, Ghasi Ram, Professor of Mathematics, 1980, 1964.
Veyera, George E., Assistant Professor of Civil Engineering, 1988.
Viets, Hermann, Dean of the College of Engineering and Professor of Mechanical Engineering and Applied Mechanics, 1983.
Viglionese, Paschal, Professor of Italian, 1988, 1964.
Vittimberga, Bruno M., Professor of Chemistry, 1971, 1961.
Vosburgh, William T., Professor of Psychology, 1973, 1965.
Wacker, Margaret S., R.N., Assistant Professor of Nursing, 1988.
Wallace, William H., Associate Professor of Resource Economics, Emeritus, 1983, 1953.
Warren, David D., Professor of Political Science, 1967, 1953.
Waters, Harold A., Professor of French, 1969, 1962.
Watts, D. Randolph, Professor of Oceanography, 1988, 1974.
Weaver, Thomas F., Associate Professor of Resource Economics, 1977, 1971.
Weber, Stanley S., Associate Professor of Pharmacy, 1982, 1978.
Weeks, Richard R., Professor of Marketing, 1970.

Weisbord, Robert G., Professor of History, 1973, 1966.
Welters, Linda M., Associate Professor of Textiles, Fashion Merchandising, and Design, 1986, 1981.
Wenisch, Fritz, Professor of Philosophy, 1980, 1971.
Wessels, Cathy R., Assistant Professor of Resource Economics, 1989.
West, Niels, Professor of Marine Affairs, 1988, 1976.
Westin, Stuart A., Associate Professor of Management Science, 1989, 1983.
White, Clement A., Assistant Professor of Languages, 1988.
White, Frank M., Professor of Mechanical and Ocean Engineering, 1967, 1964.
White, Sidney H., Professor of English, 1973, 1966.
Wichelns, Dennis G., Assistant Professor of Economics–Marine Resources, 1986.
Wilde, Charles E., Jr., Professor of Zoology, Emeritus, 1986, 1975.
Willey, Cynthia, Assistant Professor of Nursing, 1987.
Williams, Gloria, Assistant Professor of Clinical Laboratory Science, 1989.
Willis, George H., Professor of Education, 1981, 1971.
Willis, W. Grant, Assistant Professor of Psychology, 1987.
Willoughby, Alan, Professor of Psychology, 1974, 1968.
Wilson, Mason P., Jr., Professor of Mechanical Engineering and Applied Mechanics, 1976, 1968.
Wimbush, Mark, Associate Professor of Oceanography, 1977.
Winn, Howard E., Professor of Oceanography and Zoology, 1965.
Wishner, Karen, Associate Professor of Oceanography, 1986, 1980.
Wolke, Richard E., Professor of Fisheries, Animal and Veterinary Science, 1981, 1970.
Wood, Norris P., Professor of Microbiology, 1972, 1963.
Wood, Stephen B., Professor of Political Science, 1970, 1967.
Woodford, David, Assistant Professor of Pharmaceutics, 1989.
Worthen, Leonard R., Director of Environmental Health Science and Professor of Pharmacognosy, 1970, 1957.
Wright, Raymond M., Associate Professor of Civil Engineering, 1987, 1981.
Wright, William R., Professor of Natural Resources Science, 1986, 1972.
Yang, Sze Cheng, Associate Professor of Chemistry, 1985, 1980.
Yang, Qing, Assistant Professor of Electrical Engineering, 1988.
Yasuhara, Akio, Assistant Professor of Finance and Insurance, 1988.
Yoder, James A., Associate Professor of Oceanography, 1989.
Young, William, Professor of Philosophy, Emeritus, 1973, 1960.
Youngken, Heber W., Jr., Professor of Pharmacognosy, Emeritus, 1980, 1957.
Zeyl, Donald J., Professor of Philosophy, 1984, 1971.
Zipkowitz, Fay, Associate Professor of Library and Information Studies, 1987.
Zoski, Cynthia G., Assistant Professor of Chemistry, 1989.
Zucker, Norman L., Professor of Political Science, 1969, 1966.

Adjunct Faculty

Aaron, Roy K., Adjunct Professor of Biochemistry and Biophysics, 1988.
Abrams, David B., Adjunct Professor of Psychology, 1986.
Apostal, Michael C., Adjunct Associate Professor of Civil and Environmental Engineering, 1978.
Arnold, Charles A., Adjunct Associate Professor of Computer Science, 1981.
Badorek, Diane L., Adjunct Assistant Professor of Civil and Environmental Engineering, 1985.
Banerjee, Pranab K., Adjunct Associate Professor of Electrical Engineering, 1980.
Berner, Paul J., Adjunct Professor of Chemistry, 1987.
Blazek, Julia E., Adjunct Assistant Professor of Microbiology, 1988.
Brown-Collins, Alice, Adjunct Assistant Professor of Psychology, 1985.
Burbank, Kenneth A., Adjunct Associate Professor of Chemical and Materials Engineering, 1989.
Cahn, Glenn, Adjunct Assistant Professor of Psychology, 1985.
Canick, Jacob A., Adjunct Associate Professor of Microbiology, 1988.
Champagne, Gerald P., Adjunct Assistant Professor of Psychology, 1985.
Colby, John J., Adjunct Professor of Psychology, 1986.
Cone, Donna, Adjunct Associate Professor of Psychology, 1982.
Crisman, Everett E., Assistant Professor of Chemical Engineering, 1989.
Cuomo, Frank W., Adjunct Professor of Physics; 1987.
Curran, James P., Adjunct Associate Professor of Psychology, 1984.
Danish, Michele A., Adjunct Assistant Professor of Pharmaceutics, 1988.
Dechow, Frederick J., Adjunct Professor of Pharmaceutics, 1989.
Dedhiya, Mahendra G., Adjunct Professor of Pharmaceutics, 1986.
Dellaporta, Stephen, Adjunct Assistant Professor of Plant Science, 1982.
DiMeglio, A. Francis, Adjunct Associate Professor of Nuclear Engineering, 1965.
Dunlap, Richard M., Adjunct Research Professor of Mechanical Engineering and Applied Mechanics, 1979.
DuPaul, George J., Adjunct Assistant Professor of Psychology, 1985.
Elmgren, S. Ragner, Adjunct Professor of Oceanography, 1987.
Erickson, Bette LaSere, Adjunct Assistant Professor of Psychology, 1981.
Evans, David L., Adjunct Professor of Oceanography, 1988.
Fisher, Douglas O., Adjunct Assistant Professor of Pharmacology and Toxicology, 1986.
Frenzel, E. Grace, Adjunct Assistant Professor of Psychology, 1980.
Friedman, Fredric Carl, Adjunct Associate Professor of Psychology, 1981.
Gentile, John H., Adjunct Associate Professor of Fisheries, Animal and Veterinary Science, 1982.
Giambalvo, Cecilia T., Adjunct Associate Research Professor of Pharmacology and Toxicology, 1979.
Gianquitti, Kathleen B., Adjunct Assistant Professor of Food Science and Nutrition, 1986.
Grant, John, Adjunct Instructor of Pharmacy Practice, 1983.
Groden, Gerald, Adjunct Associate Professor of Psychology, 1981.
Groden, June, Adjunct Assistant Professor of Psychology, 1982.
Hachadorian, Charles, Jr., Adjunct Assistant Professor of Pharmacy Administration, 1981.
Haspel, Katherine C., Adjunct Assistant Professor of Psychology, 1985.
Heelan, Judith S., Adjunct Clinical Assistant Professor of Medical Technology, and Adjunct Assistant Professor of Microbiology, 1988.
Heimendinger, Jerianne, Adjunct Assistant Professor of Food Science and Nutrition, 1983.
Howarth, Robert W., Adjunct Professor of Oceanography, 1985.
Huckel, Lorraine H., Adjunct Assistant Professor of Psychology, 1985.
Hudon, Paul, Adjunct Professor of Textiles, Fashion Merchandising, and Design, 1988.
Hurley, Daniel J., Jr., Adjunct Assistant Professor of Psychology, 1981.
Huton, Paul, Adjunct Professor of Textiles, Fashion Merchandising, and Design, 1988.
Jackim, Eugene, Adjunct Assistant Professor of Pharmacology and Toxicology, 1980.
Johnson, Douglas, Adjunct Assistant Professor of Community Planning, 1980.
Josephson, Edward S., Adjunct Professor of Food Science and Nutrition, 1986.
Kaplan, Arthur, Adjunct Professor of Plant Pathology–Entomology, 1969.
Kaplan, Edith, Adjunct Professor of Psychology, 1982.
Kavarnos, George J., Adjunct Professor of Chemistry, 1978.
Keating, J. Michael, Adjunct Assistant Professor of Labor and Industrial Relations, 1987.
Kennett, James P., Adjunct Professor of Oceanography, 1987.
Kenney, Margaret, Adjunct Assistant Professor of Microbiology, 1988.
Kimball, Marjorie G., Adjunct Assistant Professor of Microbiology, 1988.

Kirschenbaum, Susan S., Adjunct Assistant Professor of Psychology, 1987.
Kirwan, Donald F., Adjunct Professor of Physics, 1989.
Klyberg, Albert T., Adjunct Associate Professor of History, 1977, 1976.
Knauss, John A., Adjunct Professor of Marine Affairs, 1989.
Knott, J. Eugene, Adjunct Associate Professor of Psychology and of Human Development, Counseling, and Family Studies, 1975.
Kumekawa, Glenn, Director, Intergovernmental Policy Analysis Program, and Adjunct Associate Professor of Community Planning and Area Development, 1969.
Laine, Edward P., Adjunct Professor of Oceanography, 1986.
Lasater, Thomas M., Adjunct Associate Professor of Psychology, 1985.
Leahy, Michael D., Adjunct Assistant Professor of Library and Information Studies, 1984.
Lefebvre, R. Craig, Adjunct Assistant Professor of Psychology, 1985.
Lewandowski, Anthony, Adjunct Clinical Instructor of Medical Technology, 1983, and Adjunct Assistant Professor of Microbiology, 1988.
Levinsky, Herbert V., Adjunct Associate Professor of Pharmacology and Toxicology, 1988.
Lloyd, Richard, Adjunct Instructor of Psychology, 1985.
Lundgren, Raymond G., Jr., Adjunct Associate Professor of Pharmacology and Toxicology, 1975.
Malcolm, Alexander R., Jr., Adjunct Assistant Professor of Pharmacology and Toxicology, 1979.
Manheim, Patt, Adjunct Assistant Professor of Community Planning and Area Development, 1988.
Marshall, Keith, Adjunct Professor of Pharmaceutics, 1983.
Maslyn, David C., Adjunct Professor of Library and Information Studies, 1989.
Mather, Thomas, Adjunct Assistant Professor of Zoology, 1988.
Mayer, Kenneth H., Adjunct Assistant Professor of Microbiology, 1988.
Mayer, Larry A., Adjunct Associate Professor of Ocean Engineering, 1985.
Menard, Robert F., Adjunct Instructor of Pharmacy Administration, 1983.
Messier, Richard H., Adjunct Associate Professor of Mechanical Engineering and Applied Mechanics, 1982, 1977.
Miller, Donald C., Adjunct Professor of Zoology, 1979, 1975.
Monkhouse, Donald C., Adjunct Professor of Pharmaceutics, 1986.
Monti, Peter, Adjunct Associate Professor of Psychology, 1977.
Most, Albert S., Adjunct Professor of Electrical Engineering, 1974.
Neill, Stephen, Adjunct Assistant Professor of Psychology, 1982.
Nirenberg, Ted D., Adjunct Assistant Professor of Psychology, 1987.
Olsen, Stephen, Adjunct Associate Professor of Natural Resources Science, 1987.
Omar, Mostafa M.M., Adjunct Assistant Professor of Pharmacognosy and Environmental Health Sciences, 1985.
Opal, Steven M., Adjunct Associate Professor of Microbiology, 1988.
Osgood, Charles F., Adjunct Professor of Mathematics, 1980.
Otterness, Ivan G., Adjunct Professor of Pharmaceutics, 1986.
Paolino, Ronald M., Adjunct Associate Professor of Psychology, 1981.
Patton, Alexander J., Adjunct Professor of Textiles, Fashion Merchandising, and Design, 1989.
Peckol, Paulette, Adjunct Assistant Professor of Botany, 1983.
Pell, Claiborne D., Adjunct Professor of Marine Affairs, 1982.
Prager, Jan C., Adjunct Professor of Microbiology, 1988.
Phelps, Donald K., Adjunct Assistant Professor of Oceanography, 1969.
Plummer, Kevin, Adjunct Assistant Professor of Psychology, 1985.
Prager, Jan C., Adjunct Professor of Microbiology, 1988.
Rapport, Mark D., Adjunct Associate Professor of Psychology, 1987.
Raymond, Patricia M., Adjunct Assistant Professor of Gerontology, 1982, and Psychology, 1986.
Rettig, Harald, Adjunct Assistant Professor of Pharmaceutics, 1986.
Reynolds, Charles C., Adjunct Professor of Industrial Engineering, 1982.
Richardson, Roger, Adjunct Associate Professor of Psychology, 1979.
Rippey, Scott R., Adjunct Assistant Professor of Microbiology, 1984.
Robinson, Ann, Adjunct Assistant Professor of Microbiology, 1988.
Rubin, Robert V., Adjunct Assistant Professor of Computer Science and Statistics, 1989.
Rudnic, Edward M., Adjunct Assistant Professor of Pharmaceutics, 1988.
Schatz, Daniel J., Adjunct Assistant Professor of Community Planning and Area Development, 1982.
Seifert, Gerald, Adjunct Professor of Geography and Marine Affairs, 1982.
Seymour, Charles, Adjunct Assistant Professor of Microbiology, 1988.
Shaw, Robert B., Adjunct Associate Professor of Community Planning and Area Development, 1982, and Civil and Environmental Engineering, 1985.
Sheff, Michael, Adjunct Clinical Professor of Medical Technology, 1987, and Adjunct Professor of Microbiology, 1988.
Shepp, Bryan E., Adjunct Professor of Communicative Disorders, 1985.
Sherman, Kenneth, Adjunct Professor of Oceanography, 1977.
Shonting, David H., Adjunct Professor of Ocean Engineering, 1987.
Silverman, Gerald, Adjunct Professor of Food Science and Nutrition, 1969.
Sorensen, Jens C., Adjunct Associate Professor of Marine Affairs, 1985.
Steele, Richard L., Adjunct Professor of Botany, 1984.
Stetsko, Greg, Adjunct Professor of Pharmaceutics, 1989.
Stottmeier, Kurt D., Adjunct Professor of Microbiology, 1988.
Taylor, Suzanne, Adjunct Assistant Professor of Labor and Industrial Relations, 1987.
Thomas, Carol J., Adjunct Professor of Community Planning and Area Development, 1971.
Turner, Ruth D., Adjunct Professor of Zoology, 1986.
Veri, Albert R., Adjunct Associate Professor of Community Planning and Area Development, 1984.
Watkins, William D., Adjunct Assistant Professor of Microbiology, 1987.
Weisblatt, Richard E., Adjunct Assistant Professor of Psychology, 1985.
Williams, David O., Adjunct Assistant Professor of Biomedical Engineering, 1977.
Williams, Gloria K., Adjunct Instructor of Microbiology, 1988.
Winsor, Davis S., Adjunct Assistant Professor of Community Planning and Area Development, 1985.
Wood, David H., Adjunct Associate Professor of Mathematics, 1988.
Woodruff, Charles W., Adjunct Professor of Pharmaceutics, 1986.
Wright, Thomas E., Adjunct Professor of Civil and Environmental Engineering, 1983.
Young, Michael A., Adjunct Associate Professor of Psychology, 1985.
Younkin, Burrows T., Adjunct Assistant Professor of Microbiology, 1988.
Zartler, Ann S., Adjunct Assistant Professor of Psychology, 1986.

Clinical Appointments

Fimbel-Coppa, Denise, Clinical Assistant Professor of Nursing, 1985.
Generali, Joyce A., Clinical Assistant Professor of Pharmacy, 1986.
McArdle, Robert A., R.P.T., Academic Coordinator of Clinical Education in Physical Therapy, 1988.
Regan, J. Barry, Clinical Assistant Professor of Communicative Disorders, 1972.
Sherburne, Nancy, Clinical Assistant Professor of Pharmacy, 1987.

INDEX

Academic Administrators, 106
Academic and Social Codes, 12
Academic Computer Center, 6
Accounting, 23
Accreditation, 10
Adding Courses, see Drop and Add, 16
Additional Fees, 19
Address, Change of, 16
Adjunct Faculty, 113
Admission, 15
Adult and Extension Education, 45
Adult Education, 43
Advanced Librarianship, Diploma in, 61
Advanced Standing, 16
Affirmative Action, 11
African and Afro-American Studies, 104
Agricultural Experiment Station, 7
Animal and Veterinary Science, 51
Animal Pathology, see Fisheries, Aquaculture, and Pathology, 50
Anthropology, 97
Application Fee, 19
Application Forms, 119
Applied Engineering Laboratory, 8
Applied Mathematical Sciences, 24
Applied Music Fees, 19
Art, 104
Assistantships, 20
Astronomy, 89
Atmospheric Chemistry Studies, Center for, 7
Audiology, see Speech–Language Pathology, 98
Audit, 17

Biochemistry, 24
Biological Sciences, 24, 25, 50, 70, 73, 89, 102
Biophysics, 24
Biotechnology Center, 7
Board of Governors for Higher Education, 106
Botany, 25
Business Administration, 27
Business and Economics, Research Center in, 10
Business Law, 28

Calendar, 2
Campuses, 4
Candidates, Degree, 16
Carl Perkins Loan, 20
Center for Atmospheric Chemistry Studies, 7
Center for Ocean Management Studies, 7
Certificate in Commerical Fisheries, 4, 65
Certificate in International Development, 4
Certificate Programs, 4
Change of Address, 16
Chemical Engineering, 31
Chemistry, 33
Chester H. Kirk Applied Engineering Laboratory, 8
Child Development Center, 7
Civil and Environmental Engineering, 35
Class Programs, 16
Clinical Appointments, 114
Clinical Laboratory Science, 37
Coastal Resources Center, 9
Codes, Course, 22
Codes of Behavior, 12
College of Continuing Education, 4
College Student Personnel, 57
College Work-Study Program, 20
Colleges of the University, 4
Combined Enrollment, 18

Commercial Fisheries, Certificate Program in, 4, 65
Communicative Disorders, 98
Community Planning and Area Development, 38
Comparative Literature Studies, 40
Comprehensive Examination, 14
Computer Center, Academic, 6
Computer Science, 40
Confidentiality of Student Records, 12
Consumer Studies, 56
Continuing Education, College of, 4
Continuous Registration, 17
Cooperative Program in History and M.L.I.S., 55, 61
Cooperative Program in Public Administration and M.L.I.S., 61, 91
Core Facility, 7
Counseling, 57
Course Codes, 22
Course Numbering System, 13, 22
Course Selections, 16
Courses of Instruction, see appropriate programs
Credit by Examination or Equivalent, 17
Credits Earned Off Campus, 17
Criminal Investigation, Laboratories for, 9

Deadline for Admission, 15
Degree Candidates, 16
Degree Programs, 5
Degree Requirements, 13
Dental Hygiene, 104
Department Chairpersons, see Graduate Programs
Design for Manufacture Research Center, 8
Dining Services, 12
Diploma in Advanced Librarianship, 61
Dissertations, 15
Doctor of Pharmacy, 83
Doctor of Philosophy Degree Requirements, 14
Doctor of Philosophy Programs, 5
Drop and Add, 16

Economics, 41
Economics–Marine Resources, 96
Education, 42
Educational Research, 43
Electrical Engineering, 45
Elementary Education, 43
English, 48
Enrollment, 4
Environmental Data Center, 8
Examinations, Doctoral Candidates, 14
Exchange, Rhode Island Interinstitutional, 18
Experimental Statistics, see Statistics, 100

Faculty, Alphabetical Listing, 106
Faculty by Departments, see Graduate Programs
Federal Aid, 20
Fees, 18
Fees, Payment of, 18
Fellowships, 20
Final Oral Examination, 14
Finance, 29
Financial Aid, 20
Fisheries Science and Technology, 51
Fisheries, Aquaculture, and Pathology, 50
Food Science and Nutrition, 51
Food Science and Nutrition Research Center, 8
French, 52
Full-time and Part-time Students, 17

Genetics, 104
Geography, 53
Geology, 53
German, 61
Gerontology, 54, 104
Grades, see Scholastic Standing, 13
Graduate Assistantships and Graduate Research Assistantships, 20
Graduate Council, 106
Graduate Degree Programs, 5
Graduate Faculty, 106
Graduate Life, 11
Graduate School of Oceanography, 4
Graduate Student Association, 11
Graduate Study, 4
Greek, 61
Guaranteed Student Loan Program, 20

Handicapped, Services for, see Affirmative Action, 11
Health, 86
Health Services, 11, 18
Historic Costume and Textile Collection, 8
History, 55
Home Economics Education, 55
Housing, 11
Human Development and Family Studies, 56
Human Development, Counseling, and Family Studies, 56
Human Performance Laboratory, 8
Human Science and Services, 58

Industrial and Manufacturing Engineering, 63
Industrial Engineering, see Manufacturing Engineering, 63
Institute of Human Science and Services, 8
Insurance, 29
Intellectual Opportunity Plan, 17
Intergovernmental Policy Analysis Program, 9
Interinstitutional Exchange, 18
International Applicants, 15

International Center for Marine Resource Development, 9
International Development Studies, Certificate Program in, 4
International Management, 28
International Sports Management, 28
International Studies, 58
Italian, 61

Jones Campus, 4
Journalism, 104

Kirk, Chester H., Applied Engineering Laboratory, 8

Labor and Industrial Relations, 59
Labor Research Center, 9
Laboratories for Scientific Criminal Investigation, 9
Laboratories for Textile Performance Testing, 9
Laboratory for the Study of Information Science, 9
LANDSAT Remote Sensing Lab, 9
Landscape Architecture, 105
Language Requirements, 14
Languages, 60
Late Fees, 19
Latin, 61
Latin American Studies, 105
Libraries, 4
Library and Information Studies, 61
Linguistics, 61
Loans, 20

Management, 29
Management Science, 30
Manufacturing Engineering, 63
Map, Campus, 117
Marine Advisory Service, Rhode Island Sea Grant, 9
Marine Affairs, 65
Marine Programs, Office of, 9
Marine Resource Development, International Center for, 9
Marine Resource Economics, 96
Marketing, 31
Marriage and Family Therapy, 57
Marriage and Family Therapy Clinic, 8
Master of Arts Programs, 5
Master of Business Administration, 27
Master of Library and Information Studies, 61
Master of Public Administration, 91
Master of Science Programs, 5
Master's Degree Requirements, 13
Mathematics, 66
Mechanical Engineering and Applied Mechanics, 67
Medical Technology, 37
Medicinal Chemistry, 70
Microbiology, 70
Minorities, 11
Music, 72

Narragansett Bay Campus, 4
National Sea Grant Depository, 4, 10
Natural Resources, 73
New England Regional Student Program, 18
New England Studies, 105
Nondegree Status, 16
Nondiscrimination, 11
Nonmatriculating Status, 16
Nonthesis Option, 14
Notice of Change, 12
Nursing, 74

Ocean Engineering, 76
Ocean Management Studies, Center for, 7
Oceanography, 4, 78
Off-Campus Activity, 17
Office of Marine Programs, 9
Ombud, 12
Oral Examination, 14

Part-time Students, 17, 19
Pass–Fail, see Intellectual Opportunity Plan, 17
Payment of Fees, 16
Pell Library, 4, 10
Personnel, 106
Pharmaceutics, 81
Pharmaceutical Sciences, 70, 81, 82
Pharmacognosy, 82
Pharmacology and Toxicology, 82
Pharmacy Administration, 83
Pharmacy Practice, 84
Philosophy, 84
Physical Education, 85
Physical Therapy, 86
Physics, 88
Plant Pathology–Entomology, 89
Plant Science, 89
PLUS/SLS Loans for Higher Education, 20
Policy on Satisfactory Academic Progress, 21
Political Science, 90
Political Science with International Relations Specialization, 58
Professional Degree Requirements, 14
Professional Degrees, 5
Program of Studies, 13
Programs, 22
Psychology, 92
Public Administration, see Political Science, 91

Qualifying Examination, 14

Reading Education, 43
Reassessment of Fees, 19
Recreation, 86
Refunds, 19
Regional Student Program, 18
Registering for Course Selections, 16
Registration, 16
Remission of Fees, 19
Remote Sensing Lab, LANDSAT, 9
Requirements, Degree, 13
Research, 4
Research Assistantships, 20
Research Center in Business and Economics, 10
Research Resources, 4
Research Tool, 14
Research Units, 7
Reserve Officer Training Corps, 12
Resource Development Education, 45
Resource Economics, 95
Respiratory Therapy, 105
Rhode Island Interinstitutional Exchange, 18
Rhode Island Sea Grant College Program, 10
Rhode Island Sea Grant Marine Advisory Service, 10
Rhode Island Water Resources Center, 10
Robotics Research Center, 10
ROTC, 12
Russian, 61

Satisfactory Academic Progress, Policy on, 21
Schedule of Fees, 18
Scholarships, 21
Scholastic Standing, 13
Science Education, 43
Scientific Criminal Investigation, Laboratories for, 9
Sea Grant Depository, National, 10
Sea Grant Marine Advisory Service, 10
Secondary Education, 43
Senior Citizens, Tuition Waiver for, 18
Services, 11
Social Codes, 12
Sociology, 97
Spanish, 97
Speech Communication, 105
Speech–Language Pathology and Audiology, 98
Speech–Language Pathology and Audiology, Accelerated Bachelor's/Master's Option, 99
Statistics, 100, 105
Student Association, Graduate, 11
Student Employment, 20
Summer Session, 16

Teacher Certification, 101
Textile Performance Testing, Laboratories for, 9
Textiles, Clothing, and Related Art, 101
Textiles, Fashion Merchandising, and Design, 102
Theses and Dissertations, 15
Thesis Option, 14
Time Limit and Continuous Registration, 17
Transfer Credit, 15
Tuition, 18
Tuition Scholarships, 20
Tuition Waiver for Senior Citizens at Public Institutions of Higher Education, 18

University Aid, 20
University Libraries, 4
University Loans, 21
University Ombud, 12
Urban Affairs, 105
Urban Field Center, 10

Vessels, 7
Veterans' Benefits, 20

Water Resources Center, 10
Women's Studies, 105
Work-Study Program, 20
Writing, 50

Zoology, 102

CAMPUS MAP

Academic and Service Buildings

**Adams Hall 1
Adams House 112
**Administrative Services, *campus mail* 109
Agronomy Field House (Plains Rd.)
Agronomy Greenhouse (Plains Rd.)
Animal Care Facility 133
Athletic Maintenance Facility 10
Automotive Garage 3
*Ballentine Hall, *business administration* 11
*Biological Sciences Building 14
**Bliss Hall, *engineering* 15
**Business Office 61
*Carlotti Administration Building 2
*Catholic Center 21
**Central Receiving and Property 108
*Chafee Social Science Center 22
**Child Development Center 25
*Christopher House, *Hillel Center fraternity managers* 126
*Crawford Hall, *chemical engineering* 29
Dairy Barn (former) 30
Davis Hall 31
DeWolf Anatomy Laboratory 127
East Farm, *aquaculture and pathology* (off Rte. 108)
*East Hall, *physics* 34
**Edwards Hall 35
Engineering Instrument Shop 124
Episcopal Center 37
Fine Arts Center 41
*Fire Station 42
*Fogarty Health Science Building, *pharmacy* 43
Food Science and Nutrition Research Center (Liberty Lane, off Rte. 138 W.)
*Gilbreth Hall, *industrial engineering* 44
Gordon Research Center (Rte. 138 W.)
**Green Hall, *undergraduate admissions* 46
**Greenhouses 47
Hart House, *conference center, continuing education, summer session* 28
Housing Maintenance 122
Housing Storage 123
**Human Resource Administration 70
*Independence Hall 54
*Information Center 107
International Student Center 121
**Keaney Gymnasium 57
*Kelley Hall, *electrical engineering* 58
*Kirk Applied Engineering Laboratory 128
**Landscape and Grounds 114
*Library 60
Lippitt Hall, *administrative computer center* 62
Meade Field House 120
Meade Stadium 63
*Memorial Union 64
*Morrill Science Building, *life sciences* 66
*Pastore Chemical Laboratory and Annex 68
**Peckham Farm Animal Center, *animal science* 115
Planetarium 76
**Police and Traffic Division 55
*Potter Building, *health services* 77
Purchasing and Research Support 20
*Quinn Hall, *human science and services, graduate admissions* 79
*Ranger Hall, *botany* 80
*Resource Development Laboratory, *plant science, natural resources* 27
**Rodman Hall, *community planning, library school* 83
*Roosevelt Hall, *University College* 84
Ruggles House, *ocean management studies* 67
*Safety and Health 110
*Sherman Building, *capital projects* 85
Storage 81
**Taft Hall 92
**Tootell Physical Education Center 98
Transition Center 49
Tucker House 113
*Tyler Hall, *academic computer center* 100
Uhuru SaSa House 117
**Wales Hall, *mechanical engineering* 101
Washburn Hall 102
Watson House 104
Weldin House (Pharmacy Conference Center) 125
*White Hall, *nursing* 9
**Women's Center 56
*Woodward Hall, *resource development* 106

Residence and Dining Halls

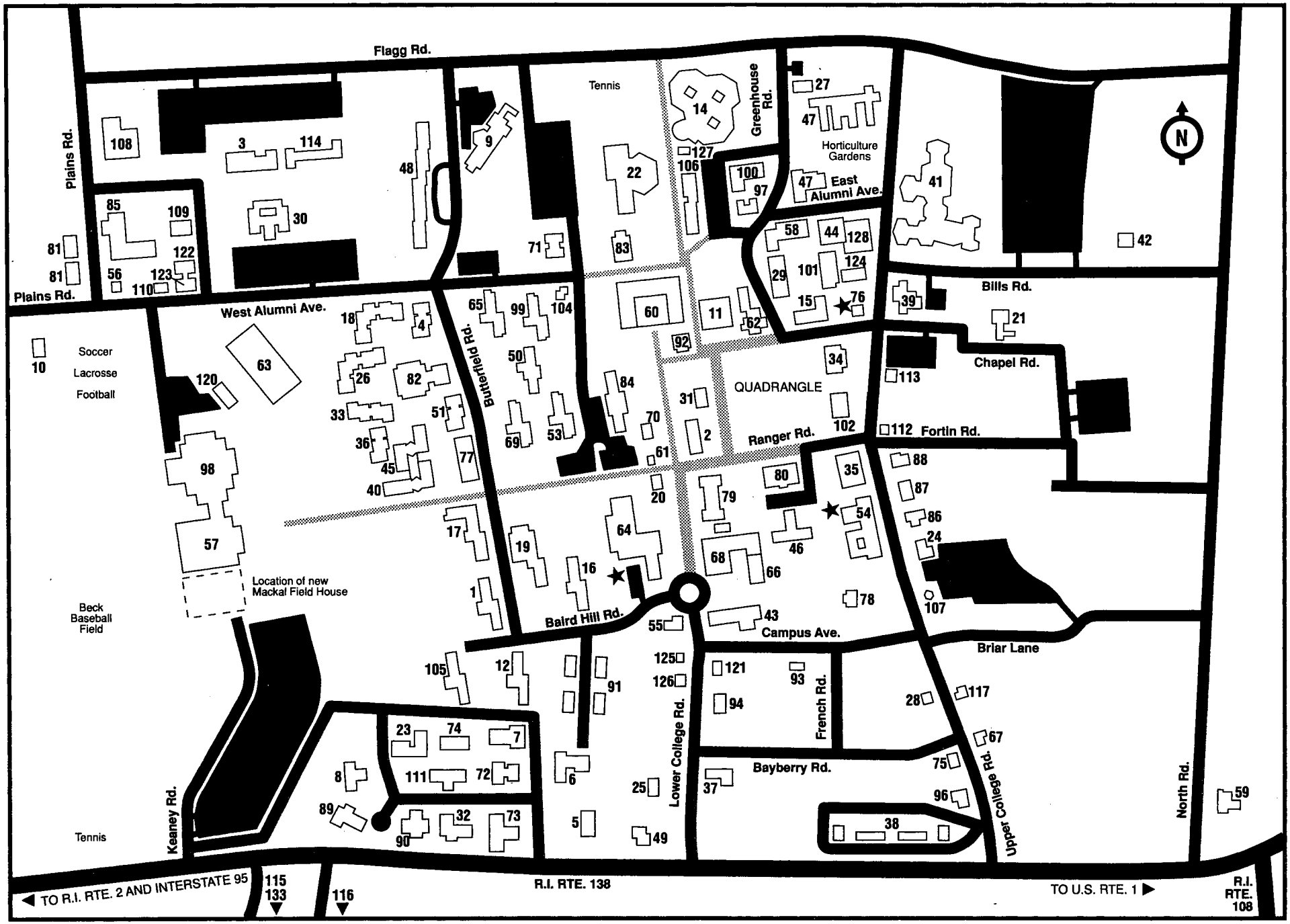
**Adams Hall 1
Aldrich Hall 4
**Barlow Hall 12
Bressler Hall 16
**Browning Hall 17
**Burnside Hall 18
**Butterfield Hall, *residence and dining* 19
Coddington Hall 26
**Dorr Hall 33
Ellery Hall 36
Faculty Apartments 38
**Fayerweather Hall 40
**Gorham Hall 45
**Graduate Village 116
**Heathman Hall 48
**Hope Hall, *dining* 50
**Hopkins Hall 51
**Hutchinson Hall 53
**Merrow Hall 65
**Peck Hall 69
President's House 78
**Roger Williams Commons, *housing office and dining* 82
Student Apartments 91
**Tucker Hall 99
*University Club 39
URI Hostel (Rte. 138 W.)
**Weldin Hall 105

Fraternities and Sororities

Alpha Chi Omega 5
Alpha Delta Pi 6
Alpha Epsilon Pi 7
Alpha Xi Delta 8
Chi Omega 23
Chi Phi 24
Delta Zeta 32
Lambda Chi Alpha 59
Phi Gamma Delta 71
Phi Kappa Psi 72
Phi Sigma Kappa 75
Sigma Alpha Epsilon 86
Sigma Chi 87
Sigma Delta Tau 89
Sigma Kappa 90
Sigma Nu 88
**Sigma Phi Epsilon 111
**Sigma Pi 73
Tau Epsilon Phi 93
Tau Kappa Epsilon 94
Theta Chi 96
Theta Delta Chi 97
Zeta Beta Tau 74

**Accessible to the handicapped*
***Partially accessible to the handicapped*

★ Visitor Parking


Flagg Rd.
Plains Rd.
Plains Rd.
West Alumni Ave.
Butterfield Rd.
Greenhouse Rd.
Tennis
Horticulture Gardens
East Alumni Ave.
Bills Rd.
Chapel Rd.
Fortin Rd.
Ranger Rd.
QUADRANGLE
Soccer
Lacrosse
Football
Location of new Mackal Field House
Beck Baseball Field
Tennis
Keaney Rd.
Baird Hill Rd.
Campus Ave.
Briar Lane
Lower College Rd.
French Rd.
Bayberry Rd.
Upper College Rd.
North Rd.
TO R.I. RTE. 2 AND INTERSTATE 95
115
133
116
R.I. RTE. 138
TO U.S. RTE. 1
R.I. RTE. 108
N

The University of Rhode Island Graduate School
Certificate of Residence for Rhode Island Residents and New England Applicants Under the Regional Student Program

Please read the regulations on the reverse side defining resident and nonresident students for tuition purposes at The University of Rhode Island. For an applicant to be considered a Rhode Island resident for tuition purposes, he or she must have established a bona fide residence in the state for one full year prior to the first class day of the first term of his or her registration. If you are a New England resident, and the program for which you are applying satisfies the conditions specified on page 18, you should submit this form to request consideration for regional status. Please note that only selected programs are available under this reciprocal program. Determination of regional status is made by the Graduate School, which will notify the applicant of the final decision. **Failure to return this form, including the certificate of residence properly certified, will result in your classification as an out-of-state student.**

Concealment of facts or untruthful statements may cause you to be subject to denial of admission and/or dismissal from the institution. In addition, Chapter 43, Volume 1, Section 11-18-1 of the General Laws of the State of Rhode Island provides severe penalties for giving a false document to a public official.

It is incumbent upon any student whose status changes from Rhode Island resident to nonresident or from regional status to nonresident status to inform the Registrar promptly of the facts relating to his/her residence.

Applicant's Name (as it appears on admission application): _____

Social Security Number: _____ Academic Program: _____ Program Code: _____

Applicant's Permanent Address _____

_____ Since (month/day/year): _____

Are you a U.S. Citizen? ☐ Yes ☐ No If not, Alien Registration Number _____

Is your visa ☐ Temporary or ☐ Permanent?

Are you applying under the New England Regional Student Program? ☐ Yes ☐ No

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Certificate of Residence

(Applicants claiming exemption from out-of-state tuition charges must submit this form properly completed.)

Certification of Town or City Clerk

This is to certify that _____ is listed on the records of this office as a legal resident of the town/city of _____ since (month/day/year): _____.

Signed _____

TITLE _____

Date _____

(Seal)

Regulations Defining Resident and Nonresident Students at The University of Rhode Island

(Adopted by the Board of Regents for Education December 2, 1971, and revised May 22, 1980.)

1. For the purposes of determining a student's classification, the word "residence" shall mean a student's domicile—the student's true, fixed, and permanent home and place of habitation.

2. A student who is a resident of the State of Rhode Island shall be classified as a "Resident Student" and shall pay all general and other fees prescribed by the Board of Regents for Resident Students in public higher education.

3. A student who is not a resident of the State of Rhode Island shall be classified as a "Nonresident Student" and shall pay all general and other fees prescribed by the Board of Regents for Nonresident Students in public higher education.

4. The term "Emancipated Student" shall mean a student who has attained the age of 18 years, and whose parents have entirely surrendered the right to the care, custody, and earnings of such student and have not claimed the student as a dependent for tax purposes for two years. If any of the aforesaid tests are not met or if a student receives regular financial assistance from his or her parents or guardians or if the parents' or guardians' income was taken into account by any private or governmental agency furnishing financial education assistance to the student, including scholarships, loans, or otherwise, the student shall be presumed to be unemancipated.

5. Any emancipated student who is a resident of the state at the time of emancipation, or having become emancipated establishes a bona fide residence in the state for one year immediately preceding the first class day of the first term of his or her registration in a public college or university and who does not hold residence in another state, shall, while he or she continues as a resident of Rhode Island, be entitled to the classification Resident Student.

6. Any unemancipated student whose parents have been residents of the state for one year immediately preceding the first class day of the first term of his or her registration in a public college or university shall, while he or she continues to be a resident of the state, be entitled to the classification of Resident Student. The residence of an unemancipated student, including those whose parents are divorced or legally separated, shall follow that of the parent who has legal custody and/or the parent who is responsible for the financial support of the student, whichever favors the student's request for Resident Student status. An unemancipated student under guardianship shall be required to present satisfactory documentary evidence of the appointment of the guardian, in addition to a certification of the residence of the guardian, which shall be considered the residence of the student unless there are circumstances indicating that such guardianship was created primarily for the purpose of conferring the status of a resident student on such unemancipated student.

7. A student from another state who is enrolled for a full program or substantially a full program at a public college or university shall be presumed to be in Rhode Island primarily for educational purposes and will be considered not to have established residence in Rhode Island. Continued presence in Rhode Island during vacation periods or occasional interruptions to the course of study will not, of itself, overcome the presumption.

8. A Nonresident Student who reaches 18 years of age while a student does not by virtue of that fact alone become a Resident Student.

9. The ownership of real or personal property in the State of Rhode Island and/or the payment of municipal and/or state taxes in Rhode Island shall be supportive evidence of, but shall not alone establish, bona fide residence.

10. An officer of each institution designated by the president shall classify each person qualified for admission to a public college or university as a Resident or Nonresident Student upon the basis of all relevant information to the Residency Officer, including but not limited to information submitted by or on behalf of the student. The Residency Officer may, as a condition of registration, require such written documents and other relevant evidence as is deemed necessary or helpful to determine the bona fide residence of the applicant.

11. An unemancipated student whose parent is a member of the Armed Forces and stationed in this state pursuant to military orders shall be entitled to classification as a Resident Student during any term the first class day of which is encompassed by the orders. A member of the Armed Forces or his or her spouse stationed in this state on military orders shall be entitled to classification as a Resident Student.

12. Any student who has been classified as a Nonresident Student and who claims that his or her status has changed during attendance at the institution may request the Residency Officer for classification as a Resident Student, submitting relevant evidence in support of this claim. If the Residency Officer determines that the claimant has become a resident, the student shall be classified as a Resident Student effective with the beginning of the term next following the determination. Decisions will be communicated to the student in written form. A student may not request a change of classification more than once in any semester.

13. Any student who is classified as a Nonresident Student by the Residency Officer may, by filing a written request with the Residency Officer within 30 days of receipt of notification of the classification, appeal the Residency Officer's decision to the Board of Residency Review, which shall consist of a student affairs officer, an academic affairs officer, and a person designated by the president of the college or university. The Residency Officer shall thereupon transmit the record, including a statement of the reasons for the decision to said Board, and the Board shall decide the appeal upon the record as made together with such additional written information as the student may furnish or the Board may require. The Board of Review shall hold a hearing. The decision of said Board of Review shall be final and there shall be no further administrative hearings.

14. Nothing in these regulations shall be construed to revoke, amend, or otherwise affect any agreement relating to student tuition and fees now in effect or entered into in the future pursuant to the provisions of the New England Board of Higher Education Compact.

15. Misrepresentation of facts in order to qualify for Resident Student classification shall be considered cause for suspension or permanent exclusion from a public college or university. In addition, Chapter 43, Volume 1, Section 11–18–1 of the General Laws of the State of Rhode Island provides severe penalties for giving a false document to a public official.

The University of Rhode Island
Graduate School Application Information

Thank you for your interest in The University of Rhode Island Graduate School. The information provided below is designed to ensure that your application receives the earliest possible consideration. The application for financial assistance is on the reverse side of this sheet. If you wish to be considered for financial aid, please be sure to enclose this sheet with your application for admission.

To apply for admission to graduate study, please send application materials to:

Graduate Admissions Office
The University of Rhode Island
Kingston, RI 02881-0807
Telephone: (401) 792-2872

PLEASE DO NOT send application materials to academic departments or to faculty members. Before your application can be considered, all materials must be received by the Graduate Admissions Office.

Application Materials Required for Consideration: 1) Two completed, signed, and dated copies of this application; 2) two official transcripts from the Registrar's Office of each undergraduate and graduate institution attended; 3) two official copies of the Graduate Record Examination scores from the Educational Testing Service (see item 10 on the admission application and the *Graduate Bulletin* for substitute tests); 4) three letters of recommendation as outlined in item 12 on the admission application; 5) a $25 nonrefundable application fee—check or money order—payable to The University of Rhode Island (please do not send cash).

Test Scores: The Graduate School will not accept test scores (GRE, MAT, or GMAT) which were earned more than five years prior to the term of admission. If your test results exceed the five-year limit, you must retake the examination.

Application Deadlines: The general deadlines for receipt of applications and supporting documents are:

April 15 for September and Summer Session admission
November 15 for January admission

PLEASE NOTE: Certain graduate programs have earlier deadlines which are published by program in the *Graduate Bulletin*. Some programs do not have entry for the January term and are so identified in the bulletin. To determine the exact application deadline for your program, please consult the *Graduate Bulletin* or contact the Graduate Admissions Office.

Letters of Reference: Three letters of reference are required of all applicants to degree programs. Some certification programs require two letters of recommendation. Please consult the *Graduate Bulletin* for information regarding teacher certification programs or contact the Graduate Admissions Office. The Letter of Reference Forms attached to the admission application MUST be submitted along with the letters of recommendation. In order to record the receipt of letters of recommendation prior to receipt of your application for admission, we ask that you record your SOCIAL SECURITY NUMBER on the reference form. Please send the reference form to your referee requesting that it be returned with the recommendation.

Program Offerings: The reverse side of the admission application form lists the graduate programs currently offered by the University. New programs authorized after the printing of this application are attached. The program name and program code number must be entered on item 5 and in item 8, if applicable.

The program list does not contain all specialty areas within programs offered. To determine the specialty areas for each program please consult the *Graduate Bulletin* or contact the Graduate Admissions Office. For more specific information regarding specialty areas please feel free to contact academic departments.

Admission: The dean of the Graduate School is the only person authorized to admit applicants to graduate study, waive any requirements, or notify applicants of the disposition of their applications. Communication from others must be considered unofficial and informal. The Graduate School cannot guarantee that applications completed after the deadline for receipt of applications and supporting documents will be considered. If applications received after the deadlines are considered, we cannot guarantee processing of the application for the desired starting date. Admission is offered for a specific starting date, and your application must be reconsidered if you subsequently request a postponement of your starting date.

All application materials become the property of The University of Rhode Island and cannot be returned to you or forwarded to other institutions. Incomplete application material and material received from accepted applicants who do not register will be held for a maximum of two years and then destroyed.

Admission to the Graduate School is based on academic qualifications and potential. The University of Rhode Island prohibits discrimination on the basis of race, sex, religion, age, color, creed, national origin, handicap, or sexual orientation, and discrimination against disabled and Vietnam era veterans.

Residency: All New England applicants must complete the Residency Affidavit on the preceding page and submit it with the application. **Applicants who do not submit a Residency Affidavit will be considered out-of-state students for tuition purposes, if admitted.**

GRADUATE SCHOOL BULLETINS and/or additional forms are available. If you have any questions, please contact the Graduate Admissions Office. We will do our best to assist you in every possible way.

The University of Rhode Island Graduate School Financial Award Application

This form should be used only by applicants seeking admission to the Graduate School who also wish to be considered for an award. To be eligible for any form of assistance you must first be admitted to the Graduate School. Please submit this form with your application for admission.

FOR OFFICIAL USE ONLY:

Awards for scholarships and fellowships are made by the Committee on Fellowships and Scholarships from ranked lists of nominees submitted by department chairpersons. Graduate assistantship appointments are initiated by department chairpersons, and research assistantships are initiated by the Principal Investigator of the grant involved. Financial need is a criterion for scholarships and assistantships and the only criterion for loan awards, but is not a consideration for fellowships.

Indicate type(s) of award for which you wish consideration:

Tuition Scholarships—Awarded to qualified students demonstrating financial need.	☐ Yes	☐ No
Fellowships—Awarded to Ph.D. candidates in recognition of achievement and promise as scholars.	☐ Yes	☐ No
Graduate Assistantships—Awarded to provide teaching and research training sponsored by URI.	☐ Yes	☐ No
Graduate Research Assistantships—Awarded to provide research training sponsored by a grant.	☐ Yes	☐ No
Loans—National Direct Student Loans, Work-Study. If you check this item, the URI Financial Aid Office will send you information on how to apply. Foreign students are NOT eligible.	☐ Yes	☐ No

Social Security Number ☐☐☐ ☐☐ ☐☐☐☐

Program for which you are applying (see admission application): _____

Name: _____ State of Residency (Country if not U.S. citizen): _____

Only applicants interested in scholarships and assistantships should complete the questionnaire below.

Your estimated budget for the next 12 months (employment income should be after taxes):

Income	*Applicant*	*Spouse*	*Applicant and Spouse*
Employment (summer and/or part-time)	$	$	$
Support from family or parents	$	$	$
Other (savings, etc.)	$	$	$
TOTAL INCOME	$	$	$

Expenses (include spouse if spouse will also be a student) Name of school spouse will attend _____

Tuition and fees	$	$	$
Books	$	$	$
Equipment and supplies	$	$	$
Rent or mortgage including heat and utilities	$	$	$
Food and household supplies	$	$	$
Clothing, laundry, and cleaning	$	$	$
Auto insurance premiums	$	$	$
Other transportation expenses	$	$	$
Medical and dental expenses	$	$	$
Child care	$	$	$
Annual debt repayment (include educational loans only if repayment has begun)	$	$	$
TOTAL EXPENSES	$	$	$
Financial Need (difference between total income and total expenses)	$	$	$

Loans outstanding to date (include installment loans on cars, personal property, and loans for educational purposes):

Source	*Amount*	*Date*	*Balance*	*Amount paid by month/quarter*
_____	$ _____	_____	$ _____	$ _____ / _____
_____	$ _____	_____	$ _____	$ _____ / _____
_____	$ _____	_____	$ _____	$ _____ / _____

Specify all dependency obligations: _____

Scholarships or grants previously awarded:

Source _____ Date _____ Amount _____

Source _____ Date _____ Amount _____

Applicant's signature _____ Date _____

The University of Rhode Island Graduate School Application

Applicant: To ensure that your application receives the earliest possible consideration, send all materials to the GRADUATE ADMISSIONS OFFICE. Please do not send application materials to academic departments. **Please print all responses.**

1. Social Security Number ___ ___ ___ ___ Starting date desired: ☐ January 19__ ☐ June 19__ ☐ September 19__

2. Name _____ (Last) _____ (First) _____ (MI) _____ (Previous or Maiden Name)

3. Permanent Address _____ (Street Address/Apartment Number) Phone _____ (Area Code Number)

_____ (City or Town) _____ (State) _____ (Zip Code)

State of legal residence _____

4. Current Mailing Address _____ (Street Address/Apartment Number) Phone _____ (Area Code Number)

_____ (City or Town) _____ (State) _____ (Zip Code)

5. Academic program desired (see reverse side) _____ Program code ___

6. Objective: ☐ PhD ☐ MS ☐ MA ☐ MBA ☐ MCP ☐ MLIS ☐ MMA ☐ MPA ☐ MOM ☐ PMD ☐ TCP ☐ GCP ☐ Nondegree

7. Expected registration: ☐ Full time ☐ Part time ☐ at Kingston campus ☐ at College of Continuing Education

8. Have you made prior application to the Graduate School? ☐ Yes ☐ No Program (see reverse side) _____

Code (see reverse side) ___ Date _____ Disposition of prior application _____

9. Colleges and Universities Attended. Please begin with your most recent enrollment and include all work completed at The University of Rhode Island including Continuing Education, work taken in nondegree status, and specify if you are currently enrolled. OFFICIAL TRANSCRIPTS must be sent directly to the GRADUATE ADMISSIONS OFFICE from the issuing institution.

Name	Office Use Only	Dates Attended	Major	Degree/Credits	Year Degree Awarded	Estimated G.P.A. on 4.00 scale

10. The Graduate Record Examination is required of all applicants unless a specific substitute is listed in the *Graduate Bulletin* under the admissions requirements for the program for which you are applying. Please indicate below the date on which you took the specified test and your scores, if known, and ARRANGE TO HAVE COPIES OF THE OFFICIAL TEST REPORT SENT DIRECTLY TO THE GRADUATE ADMISSIONS OFFICE. If you have not yet taken the test, indicate below the name of the test and the date on which you plan to take the test (THIS INFORMATION IS ESSENTIAL). The Graduate School will not accept test scores (GRE, MAT, or GMAT) which were earned more than five years prior to the term of admission. If your test results exceed the five-year limit, you must retake the examination.

Test _____ Date _____

GRE _____ (Verbal) / _____ (Quantitative) / _____ (Analytical) / _____ (Advanced) MAT _____ (Score) / _____ (Percent) GMAT _____ (Verbal) / _____ (Quantitative) / _____ (Total)

11. Citizenship (check one): ☐ U.S. citizen ☐ Immigrant ☐ Nonimmigrant Visa status number _____

The information here is requested but NOT required. Information related to racial ethnic origin is gathered only to report accurate totals to the Office of Civil Rights in compliance with Title VI and Title IX of the Civil Rights Act of 1964.

Date of Birth: ___ ___ ___ (mo. day yr.) Sex: ☐ Female ☐ Male Married: ☐ Yes ☐ No Number of Dependents _____

☐ Black (not of Hispanic origin) ☐ Hispanic ☐ Asian or Pacific Islander

☐ American Indian or Alaskan Native ☐ Caucasian (not of Hispanic origin)

Are any members of your immediate family alumni of The University of Rhode Island? ☐ Yes ☐ No

have requested to write in support of your application. Select your advisor and/or other faculty members (at least one academic reference), employers, or supervisors. DO NOT request letters from relatives, friends, co-workers, or others who have not supervised you in some professional capacity. Please read the instructions for letters of reference enclosed with this application, put your SOCIAL SECURITY NUMBER on the reference form, and have your referee return the form and letter to the GRADUATE ADMISSIONS OFFICE. Be sure your PROGRAM CODE number is printed on the reference form.

13. Indicate any original work or investigations, if published, and give complete references. (Attach reprint if available.)

14. State the more important academic, professional, or business positions you have held since receiving the baccalaureate degree (if applicable). Indicate the name of the institution or firm and the dates and type of employment.

Present employer _____

First prior _____

Second prior _____

15. Attach to this application **TWO COPIES** of a statement of purpose of approximately 300 words indicating your objectives in undertaking graduate study. In reviewing applications, considerable importance is placed on the applicant's interest in and commitment to advanced study and professional improvement.

Signature of Applicant _____ Date _____

(Please be sure that two official copies of your transcripts, statement of purpose, test scores, the $25 application fee, three letters of recommendation, as well as two copies of your application are sent to the GRADUATE ADMISSIONS OFFICE.)

Academic Programs and Program Codes: Please copy **exactly** the program name and program code which corresponds to the program to which you are applying. Enter the name and code on line 5. If you have previously applied to the Graduate School, enter the name and program code on line 8 indicating the starting date you desired, and the action, if any, taken on your previous application. Applications for nondegree status in psychology programs cannot be accepted. Permission to enroll must be granted by the department chairperson on a term-by-term basis. Specific entrance requirements for Teacher Certification, Graduate Certificate, and other certificate programs may be found in the *Graduate Bulletin*, or you may contact the Graduate Admissions Office.

DOCTOR OF PHILOSOPHY	CODE
Applied Math Sciences	027
Biochemistry and Biophysics	008
Botany	009
Chemical Engineering	410
Chemistry	021
Civil and Environmental Engineering	420
Economics–Marine Resource	061
Electrical Engineering	430
English	060
Fisheries, Aquaculture, and Pathology	233
Food Science and Nutrition	232
Mathematics	031
Mechanical Engineering and Applied Mechanics	450
Medicinal Chemistry	710
Microbiology	007
Natural Resources	254
Nursing: Primary Health Care	605
Ocean Engineering	460
Oceanography: Biological	960
Oceanography: Chemical	961
Oceanography: Geological	962
Oceanography: Physical	963
Pharmaceutics	705
Pharmacognosy	720
Pharmacology and Toxicology	730
Physics	047
Plant Science	236
Plant Pathology–Entomology	237
Psychology: Clinical	016
Psychology: General Experimental	017
Psychology: School	018
Zoology	111

MASTER OF ARTS	CODE
Audiology	063
Comparative Literature	042
Economics	057
Education	
Education Research	516
Elementary	517
Reading	518
Secondary English	519
Secondary History	520
Secondary Languages	521
Secondary Math and Science	522
Adult	524
English	060
French	071
History	065
Marine Affairs	012
Philosophy	079
Political Science	080
Spanish	078
Speech–Language Pathology	053

MASTER OF SCIENCE	CODE
Accounting	310
Animal and Veterinary Science	210
Audiology	064
Biochemistry and Biophysics	008
Botany	009
Chemical Engineering	410
Chemistry	021
Civil and Environmental Engineering	420
Clinical Laboratory Science	035
Computer Science	022
Electrical Engineering	430
Fisheries, Aquaculture, and Pathology	233
Food Science and Nutrition	232
Geology	024
Home Economics Education	530

MASTER OF SCIENCE (cont.)	CODE
Human Development, Counseling, and Family Studies	
Human Development and Family Studies	510
Marriage and Family Therapy	511
College Student Personnel	512
Counseling	515
Labor and Industrial Relations	946
Manufacturing Engineering	441
Mathematics	031
Mechanical Engineering and Applied Mechanics	450
Medicinal Chemistry	710
Microbiology	007
Natural Resources	254
Nursing	605
Nursing: Primary Health Care	615
Ocean Engineering	460
Oceanography: Biological	960
Oceanography: Chemical	961
Oceanography: Geological	962
Oceanography: Physical	963
Pharmaceutics	705
Pharmacognosy	720
Pharmacology and Toxicology	730
Pharmacy Administration	750
Physical Education: General	580
Physical Education: Health	581
Physical Education: Recreation	582
Physical Therapy	565
Physics	047
Plant Science	236
Plant Pathology–Entomology	237
Psychology: School	018
Resource Economics	235
Speech–Language Pathology	054
Statistics	023
Textiles, Clothing, and Related Art	540
Zoology	111

PROFESSIONAL DEGREES	CODE
Business Administration (MBA)	370
Executive MBA	(370)
Community Planning (MCP)	270
Library and Information Studies (MLIS)	940
Marine Affairs (MMA)	013
Master of Music (MOM)	070
Public Administration (MPA)	046
Doctor of Pharmacy (PMD)	708

TEACHER CERTIFICATE (Be sure to check TCP on front of application)	CODE
Elementary or Secondary	513
Business Education	320
Home Economics	530
Music	070
Nursery or Kindergarten	510
Physical Education	580

GRADUATE CERTIFICATE (Be sure to check GCP on front of application)	CODE
Commercial Fisheries	972
Dietetic Experience (ADA)	232
International Development	971

NONDEGREE

If you plan to apply for degree status at a later date and wish guidance from a department, use the degree codes above but check nondegree on the front of the application. If you do not want a department affiliation, use the code below:

Continuing Nondegree	991

The University of Rhode Island Graduate School Application

Applicant: To ensure that your application receives the earliest possible consideration, send all materials to the GRADUATE ADMISSIONS OFFICE. Please do not send application materials to academic departments. **Please print all responses.**

1. Social Security Number ☐☐☐-☐☐-☐☐☐☐ Starting date desired: ☐ January 19__ ☐ June 19__ ☐ September 19__

2. Name _____ (Last) _____ (First) _____ (MI) _____ (Previous or Maiden Name)

3. Permanent Address _____ (Street Address/Apartment Number) Phone _____ (Area Code Number)
_____ (City or Town) _____ (State) _____ (Zip Code)

State of legal residence _____

4. Current Mailing _____ (Street Address/Apartment Number) Phone _____ (Area Code Number)
_____ (City or Town) _____ (State) _____ (Zip Code)

5. Academic program desired (see reverse side) _____ Program code ☐☐☐

6. Objective: ☐ PhD ☐ MS ☐ MA ☐ MBA ☐ MCP ☐ MLIS ☐ MMA ☐ MPA ☐ MOM ☐ PMD ☐ TCP ☐ GCP ☐ Nondegree

7. Expected registration: ☐ Full time ☐ Part time ☐ at Kingston campus ☐ at College of Continuing Education

8. Have you made prior application to the Graduate School? ☐ Yes ☐ No Program (see reverse side) _____
Code (see reverse side) ☐☐☐ Date _____ Disposition of prior application _____

9. Colleges and Universities Attended. Please begin with your most recent enrollment and include all work completed at The University of Rhode Island including Continuing Education, work taken in nondegree status, and specify if you are currently enrolled. OFFICIAL TRANSCRIPTS must be sent directly to the GRADUATE ADMISSIONS OFFICE from the issuing institution.

Name	Office Use Only	Dates Attended	Major	Degree/Credits	Year Degree Awarded	Estimated G.P.A. on 4.00 scale
	☐☐☐☐☐☐					
	☐☐☐☐☐☐					
	☐☐☐☐☐☐					

10. The Graduate Record Examination is required of all applicants unless a specific substitute is listed in the *Graduate Bulletin* under the admissions requirements for the program for which you are applying. Please indicate below the date on which you took the specified test and your scores, if known, and ARRANGE TO HAVE COPIES OF THE OFFICIAL TEST REPORT SENT DIRECTLY TO THE GRADUATE ADMISSIONS OFFICE. If you have not yet taken the test, indicate below the name of the test and the date on which you plan to take the test (THIS INFORMATION IS ESSENTIAL). The Graduate School will not accept test scores (GRE, MAT, or GMAT) which were earned more than five years prior to the term of admission. If your test results exceed the five-year limit, you must retake the examination.

Test _____ Date _____

GRE _____ (Verbal) / _____ (Quantitative) / _____ (Analytical) / _____ (Advanced) MAT _____ (Score) / _____ (Percent) GMAT _____ (Verbal) / _____ (Quantitative) / _____ (Total)

11. Citizenship (check one): ☐ U.S. citizen ☐ Immigrant ☐ Nonimmigrant Visa status number _____

The information here is requested but NOT required. Information related to racial ethnic origin is gathered only to report accurate totals to the Office of Civil Rights in compliance with Title VI and Title IX of the Civil Rights Act of 1964.

Date of Birth: ☐☐-☐☐-☐☐ (mo. day yr.) Sex: ☐ Female ☐ Male Married: ☐ Yes ☐ No Number of Dependents _____

☐ Black (not of Hispanic origin) ☐ Hispanic ☐ Asian or Pacific Islander
☐ American Indian or Alaskan Native ☐ Caucasian (not of Hispanic origin)

Are any members of your immediate family alumni of The University of Rhode Island? ☐ Yes ☐ No

12. List the names and addresses of three persons who know you, your work, and your talent for and interest in advanced study, whom you have requested to write in support of your application. Select your advisor and/or other faculty members (at least one academic reference), employers, or supervisors. DO NOT request letters from relatives, friends, co-workers, or others who have not supervised you in some professional capacity. Please read the instructions for letters of reference enclosed with this application, put your SOCIAL SECURITY NUMBER on the reference form, and have your referee return the form and letter to the GRADUATE ADMISSIONS OFFICE. Be sure your PROGRAM CODE number is printed on the reference form.

_____

_____

_____

13. Indicate any original work or investigations, if published, and give complete references. (Attach reprint if available.)

_____

_____

_____

14. State the more important academic, professional, or business positions you have held since receiving the baccalaureate degree (if applicable). Indicate the name of the institution or firm and the dates and type of employment.

Present employer _____

First prior _____

Second prior _____

15. Attach to this application **TWO COPIES** of a statement of purpose of approximately 300 words indicating your objectives in undertaking graduate study. In reviewing applications, considerable importance is placed on the applicant's interest in and commitment to advanced study and professional improvement.

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The University of Rhode Island Graduate School
Request for Letter of Reference

PLEASE PRINT

Applicant: Please send this form to your referee.

Starting date desired: ☐ January 19___ ☐ June 19___ ☐ September 19___ Social Security Number ☐☐☐ ☐☐ ☐☐☐☐

To (Referee's Name): _____

(Applicant's Name) _____ has applied for admission to graduate study

to pursue a _____ degree in _____ at The University of Rhode Island.
Would you kindly assist us by indicating in an **attached letter**, how well and in what capacities you know the applicant; your estimate of abilities, creativeness, integrity, motivation, and potential for teaching, research, administration, and/or other professional endeavors? Please describe briefly any unusual attributes which would be of help in making a fair judgment about the application.

Please **attach** this form to the letter and mail them directly to the Graduate Admissions Office, The University of Rhode Island, Kingston, RI 02881-0807. You are encouraged to discuss the contents of the letter with the applicant. While third party confidentiality is guaranteed under the Family Education Rights and Privacy Act, the applicant has the right to view the letter and procure a copy after he or she is accepted and enrolled, unless that right is waived below. Return of this form with your letter will speed the consideration of the application. Thank you for your cooperation.

OPTIONAL WAIVER

Applicant: You are encouraged to discuss your letter of reference with your referee. As provided under the Family Education Rights and Privacy Act you may waive your right to view letters of reference. If you wish to do so, please sign below.

I hereby **waive** my right to view the letter of reference from (Referee's Name) _____ requested above.

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